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MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XIII

WITH 44 PLATES

1925

ST. LOUIS, MISSOURI

PUBLISHED MONTHLY EXCEPT JULY AND AUGUST,
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Missouri Botanical Garden Bulletin

Vol. XIII JANUARY, 1925 No. 1

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VIEW IN GARDEN AFTER ICE STORM.

Missouri Botanical Garden Bulletin

Vol. XIII JANUARY, 1925 No. 1

THIRTY-SIXTH ANNUAL REPORT OF THE DIRECTOR

Gentlemen:

I have the honor to submit herewith the thirty-sixth annual report of the Director.

Ordinarily, a discussion of the weather in a report of this character finds no place, since those who are engaged in growing plants out of doors are accustomed to taking what comes and doing the best they can to achieve satisfactory results regardless of adverse conditions. But the year 1924 included so many unusually destructive storms, as well as other abnormal conditions, involving serious damage to the Garden, that brief mention should be made of them.

The heavy freeze in January, following a period of high temperature, was the worst experience in the Garden for many years. Not only were many semi-hardy trees and shrubs killed, but plants succumbed which normally survive the winters here without difficulty. Perhaps the greatest single damage was done to the rose garden where nearly 75 per cent of the plants were killed. There was also a great deal of root damage which did not manifest itself until late in the season because of the unusually cold and wet spring. As soon as dry hot weather came, however. many plants were unable to maintain themselves, and as a consequence losses were continuously being noted throughout the summer months.

On April 8 occurred the worst hailstorm from which the Garden has ever suffered, at least since the construction of the large conservatories. Nearly 2,000 lights of glass were broken or cracked so that they had to be replaced. The dam-

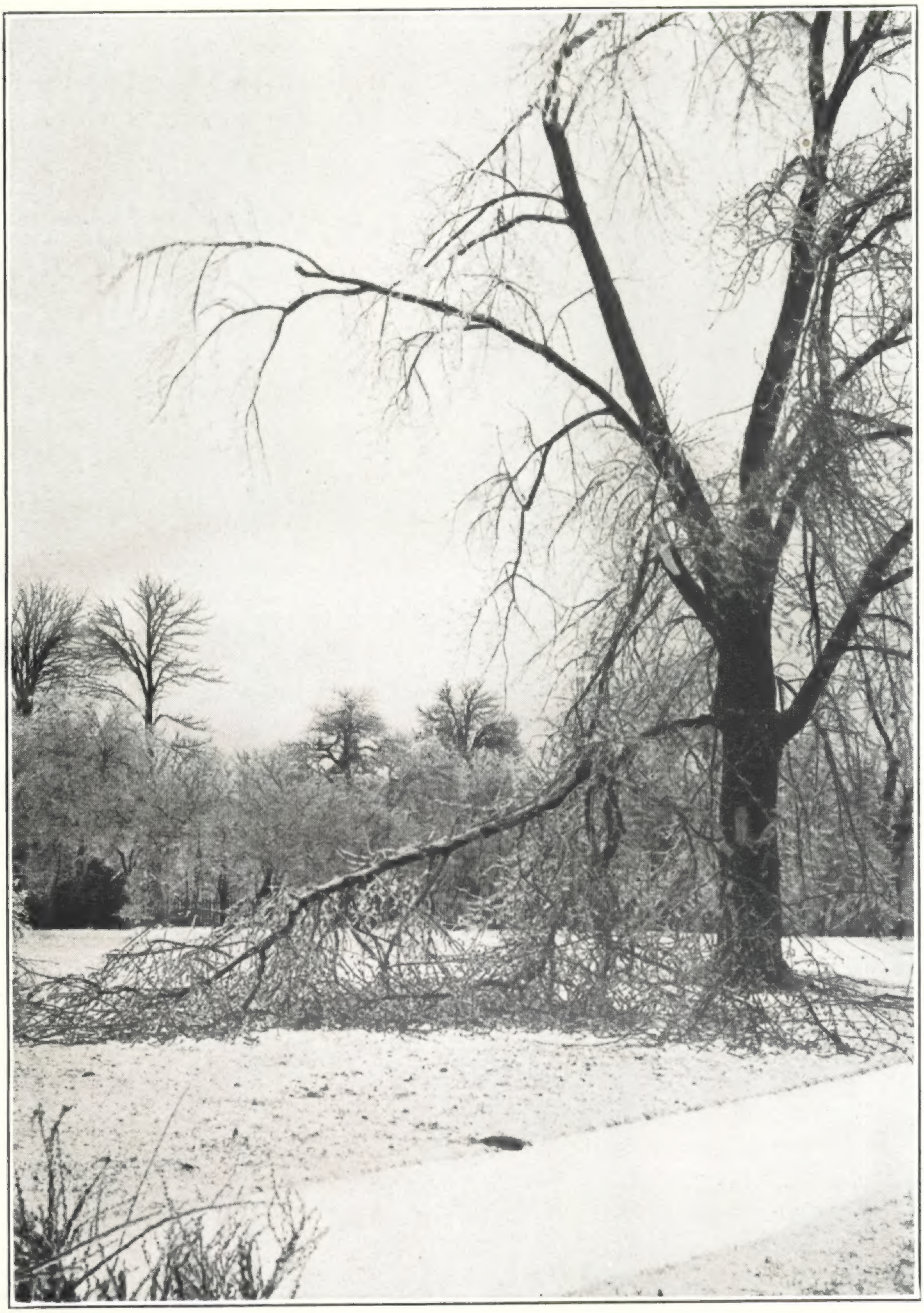
age to plants inside the house was not permanent, but many of the larger-leaved plants in the palm house, economic house, etc., were cut or broken by falling glass so that it will require some time for them to again present their normal appearance. Fortunately, plants out of doors were not sufficiently in leaf to be seriously affected, though many of the smaller branches and buds were broken off.

Excessive rains during the spring and early summer caused much damage to walks, and the effect upon the lawns, together with the damage from the January freeze, was manifested throughout the season, chiefly because of the impossibility of keeping out the wild grasses which flourish under such wet conditions. An unusual amount of time had to be devoted to the weeding and care of the lawns throughout the summer and fall, yet in spite of this fact they have not presented such an unsatisfactory appearance in years.

A very severe windstorm on July 17 either uprooted or so seriously damaged 150 of the larger trees in the Garden that they had to be removed. For several weeks after the storm a large force of men were engaged in clearing up the resulting refuse, and the surgical treatment of the damaged trees and shrubs left standing was not completed until the end of the year. Some glass was lost through the action of the high wind, but this was not as great as might have been expected.

While excessive smoke in the atmosphere during the fall and winter months is to be expected, an unusually dense cloud hovered over the Garden on October 25, 26, and 27. Due possibly to the long period for which the cloud remained, rather than to its density, the damage, particularly to greenhouse plants, was considerable. Flowers in bud or expanded were affected to an extent that made their removal necessary, and quantities of leaves from the orchids and other plants of this type dropped to the ground. Unfortunately, the immediate effect of the smoke damage is frequently not the most serious aspect, since the debilitating influence of the smoky atmosphere may manifest itself in the general health of the plant after a considerable period.

To round out a year of most unusual climatic disturbances, on December 8 the Garden was visited by an ice storm which



DAMAGE OF ICE STORM TO SOFT MAPLE AT THE GARDEN.

ACCUMULATION OF ICE ON HAW BERRIES AND BRANCHES.

completed the destruction of many trees and shrubs which had survived the windstorm of July. While the effect of the ice was not as severe as in certain regions outside of the city, it was sufficient to require much additional surgical work on the trees and shrubs and resulted in the loss of some fine specimens of plants and trees which have been growing in the Garden for the last quarter century or more.

This series of catastrophies involved an additional expense to the Garden of about $10,000, including the replacement of shrubs and trees and the cost of extra labor and material. It is of course impossible to estimate the monetary value of many of the larger and finer trees destroyed.

The more strictly scientific aspects of the Garden activities such as are included in the maintenance of the library, herbarium, and laboratories, as well as the results obtained from the work of the graduate students in the Shaw School of Botany and the pupils in the School for Gardening, are referred to elsewhere in this report. The floricultural and horticultural work covers such a wide field and influences so many special lines that the activities represented in producing the results are but imperfectly recognized and seldom appreciated by the general public. Apart from the actual growing and care of the plants in the various collections indoors and outdoors, almost half of the Garden force is engaged for the greater part of the year in departments which have to do with the maintenance of the physical part of the plant. This includes the operation of the central heating plant, construction work, such as carpentry, painting, glazing, care of walks and roads, attendance at the main gate, etc. The outdoor work at the Garden is under two heads: the floral department, and one having to do with the trees, shrubs, lawns and nursery. In the outdoor floral department the following special features may be noted:

Italian Garden.—This is in some respects the largest and most conspicuous feature. Bounded on three sides by the large conservatory, with an Italian pergola on the other side, it is recognized as one of the finest examples of this type of planting in the country. Over 25,000 plants in 136 beds are handled in this garden every year, and in addition there are

over 3,000 feet of hedge which must be kept trimmed and conform with the formal lines called for in such a garden. There are also thirty-five flower boxes and vases which require nearly 1,000 plants to fill.

Rose Garden.—Not counting the collection of climbing roses on the bordering trellis, there are 182 beds in this garden requiring over 5,000 rose plants. In addition, back of the wall there is a test garden for roses devoted to the growing of many new varieties as well as to hybrid seedlings, now numbering several hundred, which have been developed at the Garden.

Iris Garden.—This garden which was augmented considerably during 1923, now comprises over 3,000 clumps of some 300 varieties. Additional beds are constantly being added, a recent one being devoted to the marsh-loving iris, including a start towards a collection of Japanese iris. In this same garden there have also been established about a hundred varieties of peonies, representing many of the newer sorts, and some of the perennial delphiniums are also to be found here.

Economic Garden.—This covers an area of about an acre and, as its name indicates, contains such plants of economic importance as can be grown out of doors. About 60 of the more unusual garden and farm crops are grown here each season. There are also four sample back-yard gardens such as might be established on a city lot, a collection of plants suitable for hedges, and various other groups of special interest to those concerned in improving their home grounds. The trellis surrounding this garden, where are grown both hardy and annual vines suitable for this region, is a feature much appreciated, and the fruit trees growing along the main walk, trained in fan and other designs, always attract attention.

Test Garden.—While this garden occupies but about a quarter of an acre and is not designed as an ornamental feature, it has been the means of furnishing much desired information to amateurs. Each year there are included several hundred of the novelties featured by various seedsmen in this country and abroad. It is now generally known that at the proper season those plants especially featured in

the seed catalogues may be seen blooming in this garden, and the number of visitors who come primarily to get this special information increases yearly.

Water-lily Pools and Bordering Flower-Beds.—A water garden requires quite as much attention, if not more, than an ordinary flower-bed. Most of the lilies are propagated from seed, and the young plants have to be maintained in tanks of heated water until they can be set out in the pools in the spring. Constantly through the growing season the plants have to be gone over for the removal of dead leaves, treated for certain diseases to which they are subject, the soil in which they grow must be fertilized, and in many other ways they require attention. In addition, because of the place which the Garden has attained as being perhaps the institution in this country giving the most attention to the production of new varieties, there is much additional work incident to the crossing and development of hybrids. The floral displays bordering these pools vary from year to year. Some 5,000 tulips are usually shown here in the spring, to be followed by a varied combination of foliage and blooming plants, and in turn are replaced in the fall by a few varieties of hardy chrysanthemums which have been shown to be best adapted to this region.

Native Wild-Flower Garden.—West of the pergola an area has been set aside in which to maintain as complete a collection as possible of the wild flowers of Missouri. There are now between three and four hundred species of plants established here, but since many of these are difficult to maintain, it requires almost the entire attention of one gardener, with some assistance, throughout the growing season, to take care of the additions and replacements necessary.

Nursery.—An area of about four acres, all that under existing conditions can be devoted to this work, is set apart back of the wall for a miscellaneous collection of trees, shrubs, and hardy perennials. Certain plants designed for indoor floral displays, such as chrysanthemums, dahlias, etc., are likewise grown here for a part of the time.

Trees, Shrubs, Lawns, etc.—In addition to the floral collections listed above, there are 23 acres of land devoted to trees

and shrubs, and in addition about the same amount in lawns. The trees and shrubs require constant attention, such as pruning, cultivation, spraying, and occasionally mulching and fertilizing. The lawns are a constant care and expense, requiring in addition to weekly mowing, periodical raking, seeding, and at least once a year a light mulching.

Conservatories and Greenhouses.—There are more than two acres under glass at the Garden. The conservatories open to the public contain plants permanently set in the ground and, while this reduces considerably the routine care, the necessary cultivation, fumigation and keeping the houses neat and attractive require constant attention. Only those who have had experience in maintaining such collections realize the amount of labor necessary to keep plants of this character free from insect pests and diseases, and visitors from other institutions never fail to comment upon the extraordinary success of the Garden in accomplishing results in this direction. The growing of material for the floral displays in the large house set aside for this purpose is, of course, a considerable part of the routine work. From one year's end to the other, including the orchids, nearly 20,000 plants are brought into bloom for the various flower shows, and the taking down of a show, to be replaced with the following one, necessitates the expenditure of much time and labor in the mere handling of the plants.

Incidentally, it should be mentioned that a part of the time of the horticulturist and floriculturist and several of the gardeners is devoted to teaching in the School for Gardening. For all of the work above mentioned, both out of doors and in the greenhouses, exclusive of the heating plant and construction and repair work, the Garden employs a force of but twenty men. A larger force would permit not only greater perfection in the Garden as it at present exists but would also provide for the addition of features which, while long contemplated, cannot be undertaken because of lack of sufficient revenue.

NEW PLANTINGS

The large amount of replanting necessitated because of the freeze and storms during the year has made it impossible to extend the plantations in the Garden to any considerable extent. The construction of a walk of stepping stones from the Linnean Garden to the entrance to the floral display house made it possible to establish an English perennial border at this point. A considerable number of shrubs were planted to screen this garden, and even during the first season the planting constituted a real addition to the colorful effect which should be found at suitable places in a botanical garden. With the exception of a double row of linden trees set out near the office and a few small shrubbery patches, this border constitutes about all that may be regarded as distinct additions to the planting plan. The usefulness of the various out-of-door collections has been much augmented, however, by the addition of over 1,000 permanent labels. These are made of a non-rustable alloy, with the common name and Latin name and country of origin in raised letters which are blackened. Even the small varietal names for roses and iris can be easily read, and the labels for trees and shrubs, while they cannot be regarded as decorative, are as unobtrusive as is possible for this necessary adjunct to a garden which is supposed to be informational as well as beautiful.

FLOWER SHOWS

The usual flower shows have been held throughout the year, including the annual show in May of the Garden Club of St. Louis. The second dahlia show was held in October, and the chrysanthemum show, because of the favorable season, was staged about two weeks earlier than usual. This permitted the installation of the orchid show by the end of November. Since this and other special flower displays have received attention in preceding numbers of the BULLETIN, it is not necessary now to make further reference to them except to note that out-of-town publicity given to the flower shows of the Missouri Botanical Garden has increased considerably during the past year. Special accounts of these displays have

been sent out over the radio, and through the moving pictures people now have the opportunity of seeing our chrysanthemum and orchid shows in practically every city of the United States. Last year the orchid show film went into the international circuit and was released simultaneously in New York, London, Paris, and Berlin.

At the first orchid show of the American Orchid Society held in Boston, May 8-11, the Garden made a small exhibit for which it received a silver cup. It was likewise awarded a silver medal for a display of colored photographs illustrating the collection and shipping of orchids in 1923, from South America.

CONSTRUCTION AND REPAIR WORK

No single large job of construction has been undertaken during the year. Attention has been primarily directed to painting and repair work, and it can be stated that the physical condition of the property at the Garden was never as good as at present. All wood and metal of the interior of the large conservatories, as well as certain of the smaller greenhouses, has received two coats of paint. Advantage was taken of the opportunity afforded to dip the wire-mesh fence, taken down from around the new subdivision, and all the iron fence in place, with the exception of that on Magnolia Avenue, has been painted. The roofs of the various shops and sheds were repaired after the hailstorm and have been treated with preparations calculated to prolong their lives. The residence of the Director received two coats of paint, and many small jobs too numerous to mention have been taken care of. The glass ends of the lantern on the palm house which have in the past been frequently damaged by wind, have been replaced with sheet iron. The experiment seems to be a success, since not only has the breakage of glass at this inaccessible point been stopped, but in the roofs below, due to glass falling from above, it has also been eliminated.

The numerous wooden flower-boxes in the Italian Garden have been replaced by new concrete boxes of the same design. The wooden posts of the trellis at the south end of the economic garden have likewise been replaced with concrete

posts. A new concrete road leading in from Alfred Avenue to the boiler house was constructed during the summer, and a hard-surface road connecting with the concrete road and leading to the hay barn has likewise been finished. Much filling in and grading back of the boiler house, incident to the elimination of the old creek, has greatly improved this part of the Garden, and as soon as suitable plantings can be established this will prove to be a most attractive spot. The wire-mesh fence has been re-erected along the new western boundary of the Garden, which is now Alfred Avenue, and the Garden is once more completely fenced. The heating plant was thoroughly gone over during the summer and one of the boilers retubed.

A complete darkroom with all modern improvements has been established for the benefit of the Garden staff and pupils, in the basement of the School for Gardening building (formerly Mr. Shaw's country home). Minor matters, such as replacing the wooden staging with permanent rock work in the floral display house, might be enumerated, but while these in the aggregate account for a considerable portion of the money and labor expended in the Garden during the past year, they hardly seem worth while listing in detail here.

OUT-OF-TOWN ADDITION TO THE GARDEN

In the annual report for 1923 there was discussed at length the desirability and necessity of securing an additional tract of ground sufficiently far from the city to be free from the damage due to atmospheric pollution. Announcement was made that the Circuit Court had authorized the sale of the unimproved western portion of the Garden which would provide the necessary revenue for such an out-of-town addition. This tract, amounting to about fifty acres, was subdivided, improved with the necessary streets, sewers, and sidewalks, and is now on the market. It has been pronounced one of the best, if not the best, lay-outs for a subdivision planned for St. Louis within recent years and the character of the improvements is of an equally high grade. Sufficient lots have already been sold to justify an active hunt for a suitable location for the out-of-town garden. Numberless properties

have been examined, and it is hoped that by next spring a location will have been found which will not only meet any immediate needs of the in-town garden but which, through gradual development and improvement, may ultimately be worthy of becoming the successor to the existing city garden. It is not anticipated that the present location of the old garden will have to be abandoned for many years to come, since its accessibility is one of its important assets. However, that ultimately the present location may have to be abandoned seems certain if the history of other botanical gardens within the limits of a city is any criterion. Even Kew Garden, as far as it is from London, is beginning to feel the effect of the smoky atmosphere and has been forced to acquire a small tract of land in a district far removed from the city in order to establish a reservation for evergreens.

SCHOOL FOR GARDENING

Pending a reorganization of the School for Gardening no new students were admitted in the fall of 1924. There are now twelve vocational students and five regular students in the school. That there is an opportunity at the Missouri Botanical Garden for a type of training such as is not at the present time given anywhere else in the country is now universally recognized, but just the direction which this training should take has not as yet been fully settled. The lack of a formal degree, such as is given by an agricultural college or similar educational institution, is a disadvantage to some of the graduates of the School for Gardening. Whether the school should lower its admission standards and devote its attention primarily to training practical gardeners, or whether it should, in connection with some educational institution, establish what might be regarded as a school of landscape architecture is now under consideration. With the exception of not granting a degree, the school is at the present time attempting to do both these things, which naturally is not as satisfactory as though it concentrated in one line or the other. A few changes were made in the organization of the school at the beginning of the present year, the course in economic botany being broadened to provide a sufficient

background for work in plant materials. Certain projects have been undertaken by the pupils which have a direct bearing on their work. This includes special study in the care and propagation of roses, testing the efficiency of new methods, and securing rooting of hardwood cuttings; a study of the night and day-blooming water-lilies, the life cycle and hybrid possibilities of the poinsettias, etc. The third-year pupils have devoted much time to the special problems set by The National Conference on Instruction in Landscape Architecture in competition with various other landscape schools in the United States.

ANNUAL BEQUESTS

The annual flower sermon, provided for in the will of Henry Shaw, was preached at Christ Church Cathedral on May 18, by the Rev. Theodore Sedgwick, D.D., Rector of Calvary Church, New York City.

The bequest provided by Mr. Shaw for "premiums or prizes at a flower show or exhibition" was divided between the St. Louis Flower Show Association and the Garden Club of St. Louis, both of these organizations having held shows during the year.

RESEARCH AND INSTRUCTION

Investigations of an experimental nature have been pursued during 1924 along the major lines previously emphasized. More attention has been devoted to problems involving physiological pathology, and this is a natural development of the researches that have been conducted in previous years on the physiology of the fungi. For graduate students in the Shaw School of Botany a special course in physiological pathology has been offered. The study of mosaic diseases has yielded new facts of importance and has led to the determination that a consistent and sustained study of variegation in general is a proper direction to give this work in the future.

The continuation of the sulphur fellowship, established by the Crop Protection Institute, to October, 1924, has made possible further interesting progress in the production of

promising colloidal sulphur preparations as spray materials. Several of these new fungicides were subjected to a first test in the orchard during the past spring and summer. These tests were conducted in Missouri, Michigan, and Pennsylvania.

Investigation of the subterranean algal flora has been continued and results will soon be ready for publication. There is also being compiled the records obtained from the Owen atmospheric pollution machine which it is believed will furnish the first scientific and accurate account of the condition of the air in St. Louis.

For the first semester of 1924-25 there are being offered the usual research courses in the various aspects of botany, also three lecture-laboratory courses, a special lecture course, and seminar.

Published Articles.—Since the previous report four numbers of the Annals have appeared, including No. 4 of Volume X, and Nos. 1, 2 and 3 of Volume XI. The articles appearing in these numbers in the order of publication are as follows:

Klotz, L. J., "Studies in the Physiology of the Fungi. XVI. Some Aspects of Nitrogen Metabolism in Fungi." Vol X, pp. 299-368.

Beals, Cora Mautz, "An Histological Study of Regenerative Phenomena in Plants." Vol. X, pp. 369-384.

Young, R. T., "Notes on the Physiography of North Dakota and the Conditions in Certain of Its Waters." Vol. X, pp. 385-392.

Moore, George T., and Nellie Carter, "Algae from Lakes in the Northeastern Part of North Dakota." Vol. X, pp. 393-422.

Burt, E. A., "The Thelephoraceae of North America. XIII." Vol. XI, pp. 1-36.

Burt, E. A., "Some Wood-Destroying Fungi of Java." Vol. XI, pp. 37-42.

Wolpert, F. S., "Studies in the Physiology of Fungi. XVII. The Growth of Certain Wood-Destroying Fungi in Relation to the H-ion Concentration of the Media." Vol. XI, pp. 43-97.

Grant, Adele L., "A Monograph of the Genus Mimulus." Vol. XI, pp. 99-388.

Besides the contributions listed above, attention may be

drawn to many shorter and more popular articles in the BULLETIN, likewise to several articles appearing in garden-craft periodicals not published by the Garden as follows:

Anderson, Edgar, "Genetic Basis of Self-Sterility in Nicotiana," Genetics, January, 1924.

Carter, Nellie (Editor), West's Algae, Vol. V. 1924.

Moore, George T., "The Feeding of Plants," Bulletin of the Garden Club of America, November, 1924.

Scientific and Popular Lectures and Papers.—During the year a number of lectures have been delivered or papers read, on scientific and popular topics by members of the scientific and Garden staffs to special audiences as follows:

B. M. Duggar, February 11, before the Department of Medical Zoology, Johns Hopkins University, "The Present Status of Virus Diseases of Plants."

G. H. Pring, February 28, before the St. Louis Flower Show Association, "Co-operation by the Garden with Local Flower Shows."

Hermann von Schrenk, March 5, before the Daughters of the American Revolution, "Forestry in Missouri."

George T. Moore, March 7, broadcasted a talk from Stix, Baer and Fuller Radio Station, "The Black Smoke Tax."

B. M. Duggar, March 10, before the Society for Hygiene, Johns Hopkins University, "The Toxicity of Sulphur."

B. M. Duggar, March 13, before the Journal Club in Medical Zoology, Johns Hopkins University, "Hydrogen-ion Concentration, a Factor in Absorption and Metabolism."

Hermann von Schrenk, March 19, a lecture at the University of Wisconsin, "Timber as an Engineering Material."

George T. Moore, April 3, before the Women's Chamber of Commerce, St. Louis, "Lawns and Spring Gardens."

B. M. Duggar, April 3, before the Biological Journal Club, Johns Hopkins University, "Filterable Viruses."

B. M. Duggar, April 10, before the seminar of Medical Zoology, Johns Hopkins School of Hygiene, "Parasitism Among Fungi."

Edgar Anderson, April 15, before the Scoutmasters of the Central District, St. Louis, "Nature Study."

Edgar Anderson, April 17, before the conservation section

of the General Federation of Women's Clubs, St. Louis, "Native Wild Flowers of Garden Value."

Hermann von Schrenk, April 25, before Engineering Colleges of Cornell University, "Timber as an Engineering Material."

G. H. Pring, May 15, before St. Louis Florists' Club, "The Orchid Exhibition at Boston."

B. M. Duggar, May 23, before the staff of the Boyce-Thompson Institute for Plant Research, "New Approaches in the Study of Plant Virus Diseases."

B. M. Duggar, June 21, before Kelton, Pennsylvania, Farmers' Club, "Fungus Diseases as a Farm Problem."

George T. Moore, June 25, before the Garden Club of Lake Geneva, Wisconsin, "What Goes on in the Soil."

B. M. Duggar, July 7-19, before students in plant physiology and pathology, Chicago University summer session, a course of 12 lectures on "Physiological Plant Pathology."

B. M. Duggar, July 14, before the Botanical Conference, University of Chicago, "The Significance of Cell Inclusions in Virus Diseases."

B. M. Duggar, July 17, before the physiology seminar, University of Chicago, "Ultra Filtration and Its Application in Physiological Research."

G. H. Pring, October 3, before Edwardsville, Illinois, Wednesday Club, "Fall Planting."

George T. Moore, November 10, United States Veterans' Hospital, Jefferson Barracks, "A Walk Through Shaw's Garden."

B. M. Duggar, November 18, before the St. Louis Garden Club, "The Effects of the Length of Day on the Flowering of Plants."

G. H. Pring has given his lecture, "Collecting Orchids in South America," before the following audiences: the Museum Section of the Academy of Science, January 16; the Scottish Rite Club, January 22; the Parent-Teacher Association of the William Stix School, February 12; the Rose Fanning School Patrons' Association, February 15; the Men's Club of the Church of the Redeemer, February 20; the pupils of the Clifton Heights School, February 21; the pupils of the Rose

Fanning School, February 27; Collinsville Study Club, Collinsville, Ill., March 4; the pupils of the Cleveland High School, March 11; Kennard School Patrons' Association, March 14; Shenandoah School Patrons' Association, March 17; Sutton School Parent-Teachers' Association, and the pupils of the Kennard School, March 24; Grant School Patrons' Association, April 8; Cleveland High School Parent-Teachers' Association, April 10; Buder School Patrons' Association and Clifton Heights Mothers' Circle, April 11; Good Will Club banquet at the Claridge Hotel, April 14; the Carpe Diem Club, April 21; the Nelson Presbyterian Church, Pine Lawn, St. Louis County, April 28; Fremont School geographical science class, May 5; at a banquet of the graduates of the Old Kewites, Boston, Mass., May 10; Froebel School Patrons' Association, May 16; the St. Louis Electrical Board of Trade, May 27; the junior order of United American Mechanics, September 22; the Parent-Teachers' Association of the Adams School, December 10.

During the year two European botanists of international reputation have visited the Garden and given the lectures indicated below before the scientific staff, students, and other scientists interested:

Dr. Jean Massart, visiting professor to America under the Educational Foundation established by the Commission for Relief in Belgium, March 29, "Reflexes in Fungi."

Dr. V. H. Blackman, Professor of Physiology and Pathology, Imperial College of Science and Technology, University of London, October 23, "Physiology of Parasitism."

Other Outside Scientific Activities.—As usual the members of the scientific and Garden staffs have attended various meetings during the year representing the scientific and practical aspects of plant work; likewise offices of responsibility have been held in representative societies and associations. The following list indicates some of these activities outside of St. Louis:

John Noyes attended a meeting of the Mississippi Valley Chapter, American Society of Landscape Architects, Des Moines, Iowa, February 22-23.

George T. Moore and G. H. Pring, First Annual Show of the American Orchid Society, Boston, May 8-11.

George T. Moore and B. M. Duggar, British Association for the Advancement of Science, Toronto, August 7-13.

George T. Moore, dedication of the Boyce-Thompson Institute for Plant Research, Yonkers, New York, September 24.

G. H. Pring, Flower Show of Kansas State Florists' Association, Wichita, Kansas, October 29-31.

George T. Moore, B. M. Duggar, J. M. Greenman, L. E. Tisdale and Fanny Fern Smith attended meetings of Botanical Societies affiliated with the American Association for the Advancement of Science, Washington, D. C., December 29-January 1.

B. M. Duggar and J. M. Greenman have continued during the year as editors of the sections "Physiology" and "Taxonomy of Vascular Plants," respectively, in "Botanical Abstracts."

Hermann von Schrenk has served since March 21 as president of the Missouri Forestry Association.

B. M. Duggar has represented Physiology in the Division of Biology and Agriculture of the National Research Council and has also served as vice-chairman for that division.

Graduates, Fellows, and Investigators.—The experimental research, as heretofore, has been conducted by members of the scientific staff of the Garden, graduate students registered as candidates for degrees in the Henry Shaw School of Botany of Washington University, and special research assistants or investigators engaged upon co-operative or independent investigations. Of the latter the following, not candidates for degrees, have used the resources of the research laboratories: Dr. Joanne K. Armstrong, formerly research assistant; Dr. G. M. Armstrong, formerly assistant professor of botany in Washington University; Dr. G. W. Freiberg, formerly instructor in botany in Washington University; Dr. Nellie Carter, formerly research assistant; Dr. Roland LeGarde, scientific assistant.

Graduate Students.—During the calendar year the following graduate students have been in residence: Dorothy M. (Mrs. Edgar) Anderson, formerly teaching fellow; Walter J. Bach;

C. C. Epling, former Lackland Research Fellow; Everett Fogg Davis, instructor in Washington University; Grace Gilmor, formerly Jesse R. Barr Fellow; Myrle E. Grenzebach, Meta Gummersheimer, C. E. Kobuski, Ella Pumphrey (Mrs. Harry M.) Miller, Emery R. Ranker, Fanny Fern Smith, Louise M. Stupp, and L. E. Tisdale.

Rufus J. Lackland Fellows.—Holders of these fellowships for the academic year 1924-25 are as follows: Walter J. Bach, B.S. and M.S., Washington State College, Junior Pathologist Fruit Disease Investigations, Bureau of Plant Industry; Clarence Emmerer Kobuski, B.S., Cornell University; Emery R. Ranker, B.S. and M.S., Utah Agricultural College Assistant Department of Horticulture, Utah Agricultural College.

Jesse R. Barr Fellow.—Fanny Fern Smith, A.B. and M.S., Washington University.

Teaching Fellows.—Myrle E. Grenzebach, A.B., Oberlin College; Ella Pumphrey (Mrs. Harry M.) Miller, A.B. and M.S., Ohio Wesleyan College, Graduate Assistant, University of Illinois.

Fellowship of the Crop Protection Institute.—This fellowship, mentioned in previous reports, was maintained until October, 1924, by the Crop Protection Institute under the auspices of the National Research Council, as noted for 1923. Lionel E. Tisdale, B.S., Alabama Polytechnic Institute, M.S. Michigan Agricultural College, continued the work formerly prosecuted by Dr. H. C. Young. On the discontinuance of Sulphur Fellowships by the Crop Protection Institute, Mr. Tisdale was appointed Research Assistant to succeed Joanne Karrer Armstrong, resigned.

Degrees and Assignments.—At the commencement of Washington University, June 12, 1924, degrees were conferred upon students in the graduate laboratory of the Garden as follows: Doctor of Philosophy and Master of Science (as of 1923), Carl Clawson Epling, Lackland Research Fellow (thesis topic, "A Monograph of the Genus Monardella"); Master of Science, Fanny Fern Smith, Jesse R. Barr Fellow (thesis topic, "Pseudo-Fertility in Nicotiana"); and Louise M.

Stupp, Lackland Research Fellow (thesis topic, "A Revision of the Genus Elytraria).

Upon the completion of his work in June, 1923, C. C. Epling was appointed Assistant Professor in the University of California, Southern Branch, Los Angeles.

HERBARIUM

The herbarium has been augmented during the year by more than 32,000 specimens of vascular and non-vascular plants from various parts of the world. The largest single collection acquired is the private herbarium of the late Reverend John Davis, which is estimated to contain upwards of 20,000 specimens, mostly from Missouri, Illinois and South Carolina, but including also several small sets obtained by Doctor Davis through exchange with correspondents. The new material acquired during the year represents a wide geographical range throughout North America, Mexico, Central America and the West Indies, Europe, Asia and Australia. It is especially noteworthy, however, that the herbarium's representation of the South American flora has been supplemented materially by the acquisition of important collections from Colombia, Venezuela, British Guiana, Dutch Guiana, Brazil, Ecuador, Peru, Bolivia, Argentina, and Chile.

Several new steel cases were installed in the early part of the year; and a rearrangement, during the summer months, of the major part of the collections has relieved somewhat the congested condition of the herbarium. Additional case capacity, however, is still an imperative need in order to permit the interpolation of new material.

New Accessions.—The more noteworthy individual collections which have been added during the year are the following: Cyril Allen, 750 plants of Colombia; Arnold Arboretum, 786 plants of North America, collected by E. J. Palmer; E. Bartholomew, 206 North American fungi; T. S. Brandegee, 220 plants of Mexico, collected by C. A. Purpus; W. E. Broadway, 348 plants of Trinidad, British West Indies; B. F. Bush, 265 plants of Missouri; California Academy of Science, 224 plants mostly of Lower California; Canton Christian College, 650 plants of China; John Davis Estate,

20,000 plants, mainly from Missouri, Illinois, and South Carolina; J. A. Drushel, 155 plants of North America and 80 plants of Argentina; Dudley Herbarium, 380 plants of Brazil; C. C. Epling, 133 plants of Idaho and California; Field Museum of Natural History, 420 plants of Peru and Bolivia; Geo. L. Fisher, 149 plants of Mexico; Geo. D. Fuller, 218 plants of Starved Rock (Illinois) State Park; H. A. Gleason, 1,162 plants of British Guiana; Gray Herbarium, 187 plants of Canada, Venezuela, Dutch Guiana, etc.; F. O. Grover 170 plants of California; L. F. Henderson, 836 plants of Hood River County, Oregon; Hungarian National Museum, 500 plants of Hungary; Iowa Agricultural College, 207 grasses of Switzerland; Max Koch, 200 plants of Western Australia; Father Louis Mille, 226 plants of Ecuador; A. C. von Noe, 88 plants of Greece; North Dakota Agricultural College, 430 plants of North Dakota; E. B. Payson, 578 plants of Wyoming; R. R. Stewart, 765 plants of Punjab and Kashmir, British India; H. Sydow, 200 fungi of Germany; U. S. Department of Agriculture, 131 grasses of Brazil and southwestern United States; U. S. National Museum, 545 plants, mostly from Salvador and eastern United States; University of Cluj, 100 plants of Roumania; University of Nanking, 332 plants of China; E. Werdermann, 300 plants of Chile. Numerous small collections have been received from correspondents and friends of the Garden, which have been regularly recorded in current numbers of the BULLETIN.

Mounting and Distribution.—Nearly 12,000 specimens, received on current accessions, have been mounted and distributed in the herbarium during the fiscal year, thus making available for immediate use nearly one-half of the total amount of newly acquired material.

Field Work.—A limited amount only of local field work has been done during the year, owing to a small herbarium staff and the pressure of other duties. Several local botanists and friends of the Garden have contributed to the herbarium numerous plants of special interest. The herbarium has been fortunate in securing the services of Mr. Cyril Allen, an experienced collector of tropical plants, to make an extended collection in Colombia, South America. These collections

are adding many species not hitherto represented in the Garden herbarium.

Exchanges.—A relatively large number of specimens has been received from scientific institutions with which the Garden maintains exchange relations and from individual correspondents in different countries. During the year 3,181 specimens have been received in exchanges, and 7,038 duplicate herbarium specimens have been distributed to different herbaria in the United States and foreign countries.

Use of the Herbarium by Outside Botanists.—Numerous visiting botanists have consulted the herbarium during the year. Several loans have been made to institutions in different parts of the country for comparison and study by specialists; likewise, loans have been made to the Garden for the benefit of those pursuing a detailed study of special groups of plants. In all cases these interchanges of herbarium material have resulted in furthering the opportunity for critical study and monographic research. The recent publication in the ANNALS OF THE MISSOURI BOTANICAL GARDEN of "A Monograph of the Genus Mimulus" by Adele Lewis Grant, a work carried on mainly at the Garden, has resulted in the accumulation in the herbarium of an excellent suite of specimens illustrating this group, including type specimens, fragments, and photographs of types of practically all species of the genus.

Statistical Summary (For the year ending December 31, 1924).

Number of specimens received on new accessions:

By purchase ..	28,195	
By gift	782	
By exchange ..	3,181	
By field work..	750	
Total.....	32,908	valued at $3,290.80
Number of specimens mounted and incorporated.....	11,676	valued at $2,335.20
Number of specimens discarded from the herbarium.....	73	without value.

Number of specimens in organized herbarium	912,325	valued at	$144,358.15
Number of specimens in unorganized herbarium	84,400	valued at	7,096.66
Wood specimens, etc., supplementing the herbarium		valued at	280.00
Microscopic slides, etc.		valued at	410.10
Total valuation			**$152,144.91**

LIBRARY

The usual library staff has been employed throughout the year in caring for the present contents of the library, in entering and incorporating into the library the numerous additions of the year in the way of author's separates, books and serial publications, in attending to the needs of those who use the library, and in editing and publishing the two periodicals which are issued by the Garden for the output of its work in botanical research and horticulture and afford acceptable offerings for the library.

The library is used not only by investigators in residence here and by visitors who work up and consult here the literature in their various fields, but also by educational institutions in the region about us and in the whole United States. During 1924, 19 such institutions borrowed from us 74 books on the interlibrary plan for use by their botanists.

Number 4 of Vol. X and Nos. 1, 2 and 3 of Vol. XI of the ANNALS OF THE MISSOURI BOTANICAL GARDEN have been published during the year. These parts contain 516 pages of text, 44 text figures, and 17 plates. The ANNALS is our principal exchange for publications of scientific societies and institutions.

The BULLETIN is our other Garden publication, of which 12 volumes have been issued. While the BULLETIN was originally intended to serve primarily as a means of informing the public as to what was of particular interest at the Garden, special interest has been given to native and exotic plants suitable for the gardens of Missouri and adjoining states. It now apparently fills a distinct need among those amateurs interested in the establishment of gardens in this region. Over 60 of the articles have been republished in various horti-

cultural journals in the last three years and it is in increasing demand over the United States. Visitors from the East and the West frequently ask to see some special plant or collection, which they have read about in the BULLETIN or in some publication copying our articles.

Both the ANNALS and the BULLETIN are supplied to regular subscribers; separates of the various articles in the ANNALS are also for sale by the library. The cash receipts from such sales for the year, and for views of the Garden, were $1,536.46.

Statistical.—There have been donated to the library, or received from our correspondents during the present year 470 volumes, valued at $956.20, and 1,392 pamphlets, valued at $308.08. Two hundred and twenty-eight volumes were bought at a cost of $1,058.09, and 90 pamphlets costing $64.64. The library now contains 40,649 books and 55,116 pamphlets, a total of 95,765, valued at $138,844.57. There are also 330 manuscripts, valued at $1,609.80, and 979,043 index cards, valued at $10,307.55. A total of 7,170 index cards have been added during the year of which 945 were typewritten by library employees, and 6,225 were bought at a cost of $133.39. Three hundred and thirty books were bound.

ATTENDANCE FOR THE YEAR 1924

	Week-days	Sundays
January	3,122	4,069
February	4,637	4,840
March	4,319	3,574
April	10,465	19,953
May	12,997	22,286
June	13,573	8,512
July	16,083	8,251
August	23,114	12,746
September	24,621	11,644
October	11,750	11,430
November	21,708	36,571
December	5,520	5,386
	151,909	149,262
Total		301,171

Respectfully submitted,

GEORGE T. MOORE, Director.

STATISTICAL INFORMATION FOR DECEMBER, 1924

GARDEN ATTENDANCE:

Total number of visitors	10,906

PLANT ACCESSIONS:

Total number of plants received as gifts	3
Total number of seed packets received as gifts	4

LIBRARY ACCESSIONS:

Total number of books bought	23
Total number of books and pamphlets donated	238

HERBARIUM ACCESSIONS:

By Gift—

Anderson, Dr. E.—Plants of Wisconsin, etc.	22
Epling, Dr. Carl—Plants of California	2
Florists' Publishing Company—*Erianthus Ravennae* Beauv. from Horticulture	1
Ober, Mrs. Aurelia—*Ilex* sp. from Mississippi	3
Rose, Dr. J. N.—Photograph of *Cassia mexicana* Jacq.	1
Slominsky, J. V.—*Atriplex hymenelytra* Wats., "Winter Holly," from Death Valley, California	1

By Exchange—

Bureau of Plant Industry, U. S. Dept. of Agriculture. by Prof. C. V. Piper—Plants of Florida and the Canal Zone	2
Epling, Dr. Carl C.—Plants of Idaho and California	129
North Dakota Agricultural College, by Dr. O. A. Stevens, —Plants of North Dakota	430
Total	591

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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OF THE MISSOURI BOTANICAL GARDEN

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Director

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HERMANN VON SCHRENK,
Pathologist

JESSE M. GREENMAN,
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Missouri Botanical Garden Bulletin

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TETRADENIA GOUDOTII

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TETRADENIA GOUDOTII, A RARE MADAGASCAR SHRUB.

Some thirty plants of *Tetradenia Goudotii* (there is no common English name) were displayed for the first time at the Garden during the recent orchid show. These plants, placed under the trees to which the orchids were attached, attracted much attention, particularly from florists, and many inquiries were received as to their identity.

Despite the fact that this plant was discovered by Goudot in the vicinity of Tananarivo, Madagascar, in 1839, it is rarely seen in cultivation or mentioned in gardening periodicals. However, it is an extremely showy plant and worthy of a place in collections. In general appearance its flowers suggest the genus Stevia, under which name it was sent to the Garden by a local florist for determination. The specimen had been in his collection for several years, but he knew nothing of its previous history or how he came to have it.

Tetradenia is a much-branched shrub with robust furrowed rusty tomentose branches and crowded internodes. The leaves are ovate-oblong, obtuse or acute at the apex and petiolate at the cordate base, being covered on both surfaces with whitish-gray pubescence. The margins are doubly crenate, being more or less irregular when mature, and the veins are reticulated and raised. The flower clusters are regular, consisting of numerous densely flowered spikelets disposed upon a panicle. The calyx is campanulate externally, densely hairy, with the posterior sepal longer than the others and more or less obtuse, being ultimately closed in the fruit. The corolla exceeds the calyx in length. Stamens and style are

exserted. The seeds are narrow-elongate, oblong, and rusty green in color.

Under cultivation Tetradenia grows in one season to a height of four feet, bearing leaves two and one-half by three inches upon short petioles, all being covered with very fine hairs. Spikelets of the inflorescence when mature are three to four inches long. The entire flowering branch is three to four feet long, presenting a graceful drooping appearance. After flowering in January, the plants should be cut back to hard wood. Within a few weeks numerous lateral branches will begin to break, from which soft-wood cuttings may be taken. These root readily in sand and after periodical transplantings the final shift into seven-inch pots will suffice for development up to the flowering stage. Excellent specimens have been grown at the Garden by plunging the pots in earth outdoors for the summer, these bearing much longer and sturdier flower spikes than those kept under glass. Tho plants are affected by smoke, as is shown by the dropping of the basal leaves, those persisting having discolored margins.

Tetradenia should prove a valuable addition to the florist's stock of Christmas decoration, the only disadvantage from a commercial standpoint being the premature dropping of the flowers. The flowers begin to fall off in about a week, but this is as long as many flowers last when transferred from the greenhouse to a dwelling.

THE FEEDING OF PLANTS WITH ESPECIAL REFERENCE TO LAWNS[1]

In these days of calories and vitamines the nutrition of animals has reached such a stage of development that, given the needs of a baby or a man, the expert can generally prescribe a diet which will accomplish the desired results. Not so with plants. While the knowledge of how plants feed,

[1] Prepared by a member of the Garden staff for the Bulletin of the Garden Club of America and reprinted without change from the November, 1924, and the January, 1925, numbers.

together with their specific requirements, has increased tremendously during the present generation, the conditions under which they obtained the elements necessary for their food are so complicated that the problem is by no means as simple as for animals. Even with animals it is usually necessary to take into consideration the peculiarities of the individual so that each case is treated by itself. Such a method for plants is obviously impossible, whether it be concerned with feeding a thousand acres of wheat or a bed of annuals and perennials in one's back yard. Yet the conditions under which plants have to get their food from the soil may be quite as various as for a similar number of animals. It should also be borne in mind that the food of animals comes to them ready-made and can at once be devoted to supplying energy for growth and for work. The plant manufacturing its own food out of simple elements must in addition maintain the most delicate machinery in the highest state of efficiency in order to get the full benefit of the various substances it absorbs. So for every reason the diet of a plant is much more difficult to determine and control than that of an animal.

Let us examine for a moment the environment in which a plant lives and attempt to show some of the reasons why the application of many so-called fertilizers produces such varying results—that is, when they produce any. Leaving out of consideration the atmosphere, from which comes one of the most important elements of plant food, and considering only the soil, we are at once confronted with the fact that the medium surrounding the roots of a plant is far from being the inert mass it is frequently supposed to be. Instead of a mere sponge of disintegrated rock into which we can pour water and chemicals, to be drawn upon by the plant when needed, a teacupful of average fertile soil sustains a population of bacteria, protozoa, algae, and other microscopic organisms as great as that of the United States. In other words, the roots of all plants are surrounded by millions and millions of other plants and animals, all carrying on their life processes, using many of the same things the higher plants do, modifying and changing the soil and consequently

profoundly affecting the growth of all plants whether above or below the surface. To still further complicate things, the conditions in the soil are far from constant. One might expect a seasonal change, corresponding in general to what takes place on the earth. But so numerous are the operations being carried on by these microorganisms and so delicate the balance between their various activities that the number engaged in any particular work may fluctuate from hour to hour. This fluctuation may or may not be beneficial to the plants whose roots are imbedded in the soil.

The limits of this article will not permit going into detail as to the activities of this varied soil population. Neither can its effect, so far as is known, be discussed. The one point to be remembered is that because of the presence of these microorganisms, many of which are helpful to plant growth, most of our gardening practices affect them quite as much as the plants we are trying to assist. Making the conditions in the soil favorable for the growth of beneficial bacteria may be more important than adding a chemical fertilizer. What we do to the soil may be of benefit to the plants only because we have made conditions more favorable for the growth of the soil organisms which in their turn have contributed their labor to making a more favorable environment for the roots.

Next to the vital constituents of the soil, the physical factors influencing plant growth are if not more important, at least most difficult to control. Quite apart from the texture of the soil, which is oftentimes of great importance, the soil water, soil temperature, and soil air all have definite effects upon fertility. Water, as every one knows, plays an extremely important part in the nutrition of the plant. Not only is it the solvent by means of which many necessary food elements get into the plant through the roots, but the plant itself demands large amounts of water in its growing tissues. From two to three hundred times as much water is needed to produce a given unit of dry matter and while part of this is discharged by evaporation through the leaves, this does not reduce the great drain upon soil moisture. The water-holding capacity of a soil thus becomes an important factor in determining its fertility, and frequent cultivation, mulch-

ing, or any other means calculated to reduce evaporation from its surface, so that the plant may get its full requirement, is one of the means of insuring success in a garden.

There is no fact more evident to the casual observer than the necessity for maintaining the right temperature for living organisms of all kinds. In plants the extremes are usually further apart than in animals, but they all have an optimum range at which they do best. Most plants will not grow at a soil temperature much below 45° F., but maximum results are obtained only after the soil has reached 68-70° F. Since in the spring the soil is more often too cold than too hot, the question of practical importance is whether anything can be done to raise the temperature. Here we find that the water content of the soil is closely bound up with the temperature factor, since there is no one cause so effective in holding down the temperature of soil as the water it contains or evaporates from its surface. It requires more energy to raise the temperature of one pound of water one degree than almost any other substance. Hence the chief reason which makes a wet undrained soil colder than a dry soil is the large amount of heat which must be used in driving off the excess of moisture. Therefore, if the surplus water is drained away rapidly, rather than having to evaporate, it will greatly favor the warming of the soil. The color of the soil also influences its temperature, and a rough uneven surface has a tendency to make the soil colder than if it were level. Depth and character of cultivation have their effect upon soil temperature; indeed one of the most efficient means of conserving the heat in the soil is judicious and thorough tillage. Careful preparation of the seed bed, forming a surface mulch, may reduce the loss of water ten pounds per square foot, preventing the withdrawal of nearly 10,000 heat units from the same area. Early cultivation converts the whole garden into a hot-bed, as well as conserving moisture.

The presence of an ample amount of air in the soil is as indispensable to the life of most plants as is the supply of water and heat, for roots must have oxygen quite as much as leaves. A plant may be drowned in the underground water, and the cause is precisely the same as when a man

drowns—suffocation from lack of oxygen. All plants have not the same requirements, however, any more than have animals. Quite apart from aquatic plants which have other provisions for obtaining the necessary oxygen, some land plants, as willows and rice, seem to require very little oxygen for their roots. But in general the necessity for air in the soil for plants is practically as great as it is above ground. It is obvious that underdrainage and frequent and thorough cultivation are two of the most effective means of aerating the soil and thus increasing the fertility dependent upon air.

While water and heat and air requirements all constitute essential elements of soil fertility, their precise relations to the plant may be definitely influenced by the physical conditions above ground, namely, climate. Thus a soil fertile in one set of climatic conditions may yield poor results under other conditions. A heavy clay soil which would yield little or nothing in a cool wet climate has been shown to produce fine gardens under hot dry conditions. It does not necessarily follow then that if a fertile soil was carried from one county to another its ability to produce plants would be carried with it. Its fertility, to a greater extent than has hitherto been supposed, depends upon its correlation with climate, the right combination being necessary to produce best results. Perhaps we need not look further for an explanation of the very unequal results obtained in gardens in successive summers varying sharply as to temperature and rainfall.

Finally we come to the chemical aspect of fertility, the one with which many are most familiar. This would seem to be the easiest to establish, and since for many years countless investigators have been engaged in determining the chemical requirements of the plant, we should now have pretty exact knowledge both as to theory and practice. But let us see. Quite early in the effort to determine the elements of soil fertility it was supposed that a chemical analysis of a plant would show its needs. If so much potash, nitrogen, calcium, etc., were found in the plant, then these same substances in similar proportions should be supplied that particular plant through the soil. But practice soon proved the

thing to be untenable, and attention was then turned to the chemical composition of the soil, as the key to the problem. Experiment soon showed, however, that a mere chemical analysis of the soil failed utterly to determine its fertility, just as a chemical analysis of a plant will not show its needs and for the same reason, because in such an analysis we are measuring but one of the many factors in plant production—one which may be of comparatively minor importance. Even after years of most careful work by investigators all over the world, it is by no means certain that we know all the chemicals necessary for plant nutrition. For fifty years or more there have been listed about a dozen elements such as calcium, nitrogen, phosphorus, etc., which experiment proved were needed by all plants in relatively large amounts. For a long time these chemical substances were supposed to be all that was necessary for plant growth, plus water and oxygen and carbon dioxide of course. It was much the same condition as obtained in the animal kingdom before vitamines were discovered, and a full and complete ration, containing fats, carbohydrates, proteins, etc., was supposed to be all that was needed. Now, however, we know that other quite unsuspected substances are quite as necessary for the complete nutrition of certain plants. For example, legumes require a trace of boric acid, and manganen, silica, iodine, and similar compounds have gradually been added to the requirements of particular groups of plants.

Again the same chemical fertilizers may have an entirely different effect according to the time in the development of the plant at which it is applied, producing not only a difference in the quantity of growth, but affecting the quality or character as well.

Studies on fruit production in such plants as the strawberry would seem to indicate that the yield is more influenced by the condition of the plant in the previous autumn than by the addition of fertilizers, and apple trees have recently been shown to store a reserve of nitrogen in one season which may be drawn upon, if necessary, in a following season. Thus, such trees growing in a soil deficient in nitrogen would make quite as much growth and produce as

much fruit as other trees which had been heavily treated with nitrogenous fertilizer; a condition calculated to upset many previously formed ideas concerning the action of chemical fertilizers in a soil.

We therefore have much to learn about the application of chemical fertilizers, and one cannot be too sure that because a certain result was obtained it was due to the addition of a particular substance. The various factors involved, vital, physical and chemical, are so complex and so interwoven in their effects upon each other as well as upon the plant, that it is not to be wondered at that it looks as though the more we learn the less we know. There is no need for discouragement, however. Distinct advances are constantly being made, and through the cooperation of plant physiologists, soil chemists, bacteriologists, and others, there is bound to come a time when the feeding of plants will be no longer the uncertain and hit-or-miss practice that it now seems to be. Ever since Virgil inquired "What makes the crops rejoice" men have been striving to solve the riddle of soil fertility and each generation sees us nearer and nearer to its solution.

Fertilizing lawns. — It would seem after what has gone before that one would hardly have the temerity to make any special recommendations concerning the feeding of any plant. But once having realized that the question of soil fertilizers is not a simple matter and that "shot-gun" directions applicable for all plants under all conditions are impossible, it becomes much easier to discuss the present state of our knowledge of the requirements of a single crop like lawn grass. At least that is what I propose to do, regardless of consequence, and for this I shall hold your persuasive Editor entirely responsible.

In the first place, any lawn worthy of the name in the sense I shall use it, should be regarded as a grass garden. Usually of much greater extent than any flower or vegetable garden on the place, it receives in proportion the least attention. With a weekly pruning and an occasional application of lime (generally without benefit), or perhaps an annual reseeding (frequently at the wrong time), the lawn is ex-

pected to flourish to perfection in the way our flower beds do. Oftentimes the area devoted to the grass garden is entirely too great, and part of it could be used for groups of trees or shrubbery. Unless one is willing to give the care to a lawn that is required of a flower or vegetable garden it should not be attempted, and the same consideration should be given to its area that is necessary for any other kind of garden. Of course, if all that is desired is a covering of some sort for bare ground, weeds and wild grasses will answer this purpose very satisfactorily. But this is not a lawn.

Lawn grasses for different locations and for various parts of the country have been fairly well determined, and it is assumed that no one will attempt to grow grasses not suited to the region in which they are to be established. The only thing with which we are concerned at this time is the proper maintenance of a reasonably well-established lawn; in short, how to feed the grass so that it will continue to flourish. If plants not adapted to the climate or location have been used in the first place or the physical condition of the soil is poor, there is little that can be accomplished by adding fertilizers and the best thing to do is to plow up the land and begin all over again.

Lime.—The spreading of lime, either in the spring or fall, has come to be regarded almost universally as a panacea for every known difficulty to be corrected in a lawn. This practice has probably grown out of the successful use of lime on agricultural land, where when properly worked in it certainly will improve the texture of a heavy clay soil. But the amount of lime which can be applied to a lawn is insufficient to be of much value in this respect. For certain field crops, such as alfalfa, clover, and other legumes, lime has been proved to be beneficial. The lime requirements of these crops are apparently greater than of most other plants. and its use likewise encourages the growth of certain bacteria which are associated with their roots and help furnish them with nitrogen. Some of the worst lawn weeds, such as crabgrass and white clover, are likewise benefited by lime.

Enough lime will of course change an acid reaction to neutral or alkaline. But very few lawn soils are acid enough

to need this corrective, and some of the best lawn grasses prefer a slightly acid to a strongly alkaline condition. The theory that the presence of "moss" (which may be any one of a host of the non-flowering plants) is an indication of acidity, and consequently lime must be used, is based upon very imperfect evidence. Many of the plants regarded as "sour-soil indicators" thrive equally well or better under alkaline conditions.

While under exceptional circumstances sprinkling powdered lime over a lawn may be of some benefit, the chances are all against it. Certainly it ought to be used intelligently and only when careful test indicates its need. In the majority of cases there is already enough lime in the soil, and if the same money and effort were expended in top dressing or a nitrogenous fertilizer the results would be much more satisfactory.

Bone meal.—All grasses need phosphorus, and the easiest way to apply it is through bone meal. If the soil is deficient in this element an annual application of bone meal in the spring at the rate of ten pounds per 1000 square feet of lawn will produce good results. Many soils have a sufficient amount of phosphorus, however, and it is well to experiment on a small area, noting the result before making extensive applications of bone meal. Acid phosphate is not recommended for lawns.

Potash.—Another element required by grasses is potash, and the usual fertilizers used to supply this are either muriate of potash or wood ashes. From two to three pounds of muriate of potash per 1000 square feet once a year is sufficient. Wood ashes may be applied more liberally, but the effect is not so satisfactory. Potash is frequently present in sufficient amount in soils, and the same experiment recommended for phosphorus should be tried before using it on a large area.

Ammonium sulphate.—In recent years the use of ammonium sulphate has been widely advocated for fertilizing grasses, particularly those used on golf courses. Experience seems to show that in this chemical we have a quick-acting substance which, because of the nitrogen which is readily

obtained from it, stimulates grasses in a most satisfactory manner. On account of the acid reaction of the soil which was supposed to result from its use, it has not been recommended for any of the lawn grasses except the various varieties of bents. While it is true that the sulphur which is left after the ammonia has been used up will tend to make a soil acid, the presence of a very small amount of lime in the soil will counteract this effect. It requires considerably more than the amount of ammonium sulphate which would ordinarily be added to a lawn to turn the soil "sour," and the danger from the use of this chemical for blue grass and similar lawns has probably been exaggerated. At any rate it would appear that when properly used we have in ammonium sulphate the best single chemical fertilizer that can be used on a lawn. Because of the discouraging effect its use has upon some of the worst lawn weeds, it is superior to sodium nitrate, for in general even when quantities of these two substances are applied so as to give equivalent amounts of nitrogen, the residual effect of the sulphur is superior to the sodium.

The tendency has been to apply ammonium nitrate too liberally, on the principle that if a little was good more would be better, and some burning of lawns has resulted. It should never be used in a quantity greater than three pounds to a thousand square feet, and if applied in midsummer this amount should be cut to a third. Always apply before a rain or wash in thoroughly with the hose. Two applications, one in early spring, the other in the fall, are usually enough. The danger from burning is greatly increased during the hot summer months.

Stable manure.—Never apply fresh stable manure to a lawn. It would seem unnecessary to even suggest such a possibility, but the frequency with which it is done shows how the best intentions may result in serious damage. Well-composted manure from six months to a year old is practically free from weed seed and nothing makes a finer top dressing. So-called "mushroom soil" from old mushroom beds is admirable. There is no one substance which adds so many different elements of plant food and at the same time

improves the physical conditions of a lawn as well-rotted manure. Ammonium sulphate may be mixed with it at the rate given above and for lawns needing heavy feeding this is desirable. No two people agree as to the amount of stable manure to be added to a given area, but one fourth of a cubic yard of screened compost (and it should always be screened) to every 1000 square feet is ample, particularly if such top dressing can be given each year.

It is well to remember that vegetable and flower gardens are cultivated frequently to keep down weeds and improve the physical condition of the soil. This cannot be done with the grass garden. It is very important, therefore, that any fertilizer used be one that will benefit the grass more than it does the weeds. Lime does not do this; ammonium sulphate does. And as a last word, the most efficient means of having a perfect lawn is to so feed the grass that it will grow so luxuriantly that there will be no room for weeds. Proper attention, including reseeding at the first indication of a thin or bare spot, will accomplish wonders in this direction. "Crowd out the weeds with lawn grass" should be the slogan of every lover of a beautiful lawn. True, it can only be done by keeping everlastingly at it, but this is nothing new to the members of the Garden Club of America.

NOTES

Numbers 2-3 of Volume XI of the Annals of the Missouri Botanical Garden, containing Dr. Adele Lewis Grant's "Monograph of the Genus Mimulus" has recently been issued.

Dr. B. M. Duggar, Physiologist to the Garden, read a paper before the Washington University chapter of Sigma Xi, February 16, on "The Behaviour of the Causal Agency in Certain Plant Virus Diseases."

Professor P. L. Gainey, professor of bacteriology, Kansas Agricultural College, Manhattan, is spending a semester in the graduate laboratory at the Garden, continuing some investigations on nitrification.

Mr. G. H. Pring, Horticulturist to the Garden, gave the lecture "Collecting Orchids in Colombia, South America," before the Electrical Board of Trade, at the Forest Park Hotel, January 20, and before the brotherhood of St. Paul Evangelical Church, February 11.

Recent visitors to the Garden include Prof. P. A. Munz, professor of botany, Pomona College, Claremont, California; Prof. K. Hinze, of Gandersheim, Germany; Mr. James H. Ferriss and Mr. Baird, of the Joliet Herbarium, Joliet, Illinois; Mr. O. C. Durham, of Kansas City; and Prof. J. T. Buchholz, professor of botany, University of Arkansas, Fayetteville, Arkansas.

STATISTICAL INFORMATION FOR JANUARY, 1925

GARDEN ATTENDANCE:

Total number of visitors	7,372

PLANT ACCESSIONS:

Total number of plants received as gifts	5
Total number of seed packets received as gifts	14

LIBRARY ACCESSIONS:

Total number of books bought	48
Total number of books and pamphlets donated	564

HERBARIUM ACCESSIONS:

By Gift—	
Epling, Dr. Carl C.—Plants of California	20
Gratz, Mr. Benjamin—Fiber-specimens of *Hesperaloe funifera* Trel. from Mexico	1
Ridgeway, Robert—Plants of Illinois	102
Schrenk, Dr. H. von—*Citrus* sp. from Arkansas	1
By Purchase—	
Hanson, Herbert C.—Plants of Arizona	390
Total	514

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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Missouri Botanical Garden Bulletin

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IRIS "AMBASSADEUR"

Missouri Botanical Garden Bulletin

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IRISES

Up to about ten years ago the common yellow and blue flags, as they were usually called, were the only irises that were encountered in almost any established garden. In the past few years, however, better varieties have slowly found their way into the trade and gardens, the breeding of new irises has been undertaken by a few hybridizers in this country and Europe, and gradually iris specialists have begun sending out catalogues listing their varieties. In 1919 the Garden increased its collection with the newer irises of that time and since then has yearly added some of the better varieties.

To stimulate a greater interest in the iris the Garden proposes to stage, in the floral display house during iris time, its first iris show. A show of this kind should bring together the iris enthusiasts with their choicest blooms, as did the two annual dahlia shows. As iris time draws near, which probably will be about May 16, further information may be obtained by telephoning to the Garden—Grand 567. Ribbon prizes will be awarded, but for the first show there will be very few classes, as there is no way of knowing just what varieties will be shown.

The iris as a group has much to recommend it as one of the best perennial plants for all classes of gardeners. Whether the iris enthusiast owns his home or is a renter matters little because the iris is one of the easiest plants to establish in a new location. An iris clump may be moved at any time of the year, but there is only one good season for dividing and resetting irises and that is in midsummer. The subject of transplanting will be discussed later.

The iris is little affected by weather conditions, is extremely hardy, and will give an abundance of flowers with the minimum of attention. When we speak of irises we no longer consider the old and inferior kinds, but the newer, larger, well-branched, and better-colored ones. The texture of the blooms, height of stalks, character of the foliage, hardiness, ability to increase, and the fragrance are all factors that are now considered in producing and judging new irises. Size is not always the governing factor, although it is sometimes allowed to outweigh other good qualities.

When the word iris is mentioned the so-called German or bearded iris is brought to mind because of its popularity. However, various new species are now listed in the catalogues and are being planted more each year. It is argued that the iris season is short, but it may be considerably extended if varieties and species are selected which bloom at different periods. The order of bloom consists of first the dwarf bearded irises; second, the intermediates whose bloom stalks are about the same height as the foliage, and then the tall bearded and other species. These are followed by the Japanese irises which bring the blooming season to the beginning of July. After the Japanese irises there is one small species, *Iris dichotoma*, also called the vesper iris, that blooms in August. This iris will be described in a future number of the BULLETIN.

The first step in starting a collection of irises is to send for catalogues. The addresses of the best iris firms may be obtained from the advertisements in the leading garden journals. It matters little from what part of the country the irises are purchased as they can be shipped easily with practically no loss. When the beginner starts to consult the catalogue lists, he is bewildered by the great number of varieties and the wide range in prices. Then the various divisions or headings under which the irises are grouped will confuse him at first, but he will soon become familiar with the various terms and their meanings. Some of the catalogues contain much good information on the selection of irises, the proper planting and care, methods of hybridizing, raising plants from seed, and the rating of varieties by the American Iris

ALCAZAR

LENT. A. WILLIAMSON
EDOUARD MICHEL

SHERBERT
MME. DURRAND

Society. The figures before and after the name of the variety represent the rating, the year of introduction, the height of the stalk, and the price. The prices of some varieties will startle the beginner, because when five to fifty dollars is asked for a single rhizome, the person of moderate means is apt to throw the catalogue away with the conviction that a collection of new irises is a rich man's hobby. To be sure, such prices are never asked for a new rose, five dollars being the maximum, but if the amateur goes a little further and takes up the culture of the peony, dahlia, and gladiolus he will discover that similar high prices prevail for the latest varieties of these plants. The reason is that when some new variety has been heralded as unusually good, the demand for it exceeds the supply and naturally the price goes up. Then again, some of the new and beautiful sorts increase slowly, and, until sufficient stock is propagated, the price remains high. Many of the good varieties of the present time have come from Europe and the risk in importing, the high duty, and loss in transit are all factors that raise the price of new varieties. The beginner should not judge a variety by the price, but should consider the figure that usually precedes or immediately follows the variety name in the catalogue, this being the rating in percentage by the American Iris Society. The highest priced irises usually have no rating, since they have been introduced so recently that they have not been voted on.

Only in the last ten years has the iris made rapid strides in improvement and popularity, and on that account there is very little iris literature. However, in the garden journals of this country and Europe, particularly England, considerable space is devoted to the iris from time to time. Much pleasure and valuable information is also derived from reading the various magazines and catalogues.

It is difficult to select and recommend a list of good irises. The cost, color, height, method of branching, whether wanted for massing in the garden or for the beauty of the individual flower, rapidity of increase, and texture of flowers, are all items to be considered in choosing varieties. The illustrations show a number of good varieties at various

prices, and at the end of this article will be found a list of these and some others with their percentage ratings and the average prices as listed in catalogues at the present time.

Now is a good time to study the iris catalogues. A list of varieties wanted can be made and this compared with the irises in bloom this spring. The orders can be placed in June and the irises will be shipped in July or August, the proper months for planting. July is the better time to plant and reset irises, as they then have sufficient time to produce new roots and to form the flower buds for the following spring. Irises transplanted late in the summer or in the fall do not produce enough roots to anchor them in place, and by spring many of the plants are high out of the ground due to the heaving action of the frost. Irises that necessarily have been planted late in the season, or varieties that are not acclimated, should be covered by boards or tar-paper frames to shed the snow and rain and prevent the rays of the sun striking them when the ground is frozen. Irises transplanted in spring usually will not bloom that same year and there is danger from rotting. It is not recommended that irises be mulched as mulching induces rot. Rare and expensive irises which for some reason failed to make sufficient growth during the summer should be transplanted to pots and carried in a cold-frame during the winter.

While irises tolerate some shade, they succeed better in the open. Any sunny location may be used for a bed of irises. They are not so exacting as to soil, doing almost as well in a heavy as in a lighter soil. However, they do object to a poorly drained soil, and if planted in low places, where water stands after rains, the rhizomes will rot. A poorly drained bed should be raised, and, if necessary, beds four to six feet wide may be made by bringing in soil and holding it in place with boards, the walks between being about ten inches lower than the surface of the beds. Sand and gravel worked in the soil beneath each new iris rhizome will insure good drainage and lessen the chance of rotting.

The irises may be planted in beds in front of shrubbery or in groups in the perennial border, but if only one or two plants of a variety are grown they are better planted in

VERSICOLOR
TECTORUM

CRISTATA
FULVA

SINDJKHAT
AVALON

PARISIANA
SHEKINAH

rows until each variety has increased sufficiently to be planted in masses in other parts of the garden. There are some irises, however, that must be seen at close range and which will never be suitable for massing. For the first year or two the new irises may be planted a foot apart, but as the clumps increase in size each fan should be separated from the parent plant to increase the variety as rapidly as possible. When a sufficient number of plants of one variety has been secured they may be left undisturbed for a number of years so that the clumps may produce a large number of flowering stalks. After about three to five years the clumps should again be separated. Irises that are left too long in one location gradually decrease in size.

Of all the plants grown by the amateur there is none that can be increased so easily as the iris. By examining an iris plant one can see how the rhizome, with its sheaf of large leaves, has several new side-shoots. If these side-shoots are of sufficient size and have roots attached to them they may be removed by breaking off or severing with a knife and planting in a new location. In transplanting, it is better to cut the fan of leaves back to about four inches, this being done with pruning shears or by laying the fan on a board and cutting across all the leaves with a knife. Unusually long roots should be shortened. If the rhizome has been broken from the parent plant the frayed edges should be cut with a knife to insure rapid healing of the cut surface. It may be transplanted without any further treatment, but as an extra precaution against the iris root rot the cut surface may be dipped into a cup of powdered charcoal or sulphur. The sun is about as good a sterilizing agent as any of the various chemicals that are sometimes recommended. In planting an iris a hole should be made with a trowel, the roots spread and the soil replaced and firmed with the handle of the trowel. When the operation is complete, the rhizome, or that portion of the iris to which the leaves are attached, should barely be seen on the surface. If planted deeper in this climate irises are subject to rot and will gradually produce rhizomes near the surface. After transplanting, the plants should receive one good soaking and should again

be watered if the soil becomes quite dry as so frequently happens in midsummer. After each watering the soil should be stirred to prevent it from baking. This is important when the soil contains much clay.

As previously mentioned, the irises should not be mulched during the winter. If the foliage is left it serves as a mulch after it falls to the ground when frozen. This old foliage is best removed in spring when most of the heavy freezes are past. It is sometimes recommended to burn off this foliage to rid the beds of any insects and disease spores they may harbor, but unless it is a quick fire many of the new shoots will be injured. A safer but more laborious way is to remove all the old leaves in the spring and then burn them. This gives one an opportunity to closely examine each clump for any rot that might have lived over or was induced by extreme exposure of the rhizomes to the cold. Any rhizomes that have been lifted out of the ground by the frost should be reset.

In the spring and sometimes in the fall the irises are troubled with innumerable aphids. These should be sprayed with nicotine or a soap solution. With the exception of a few worms and the grasshoppers in the late summer other insects seldom attack the iris. The iris borer may obtain a foothold in a garden, but if the newly purchased rhizomes are carefully examined when received the danger of introducing this pest in a garden is not so great. The under sides of old rhizomes have holes where roots formerly were attached. These should not be mistaken for the work of some boring insect.

What is known as the iris root rot is the only serious disease to contend with. Leaf spot occurs in some seasons, but it is not as serious as the root rot. It does not take the beginner long to discover the presence of rot in his garden. The leaves assume a water-soaked appearance near the base and soon the whole fan of leaves falls to the ground. Upon examining the rhizome it will be found to consist of a mass of ill-smelling, slimy substance, in severe cases the entire rhizome having decayed. The odor is sufficient indication of the disease, normal decay not being so offensive.

PSEUDACORUS
OCHROLEUCA

JAPANESE IRIS
ORIENTAL IRIS

BRUNO
WM. MOHR

CARDINAL
MOA

The rotted rhizomes should be removed with the surrounding soil and burned. The remaining rhizomes should be cut to sound tissues, treated with charcoal or sulphur or a cherry-red solution of potassium permanganate and replanted in fresh soil. Possibly the rot was induced by a wet soil, and if this is the case the drainage should be improved before replanting. After a severe winter and in a wet and cold spring rot and leaf spot are more prevalent. Rot can also be introduced into a garden when receiving new varieties. Irises which have been packed too long or which have come from a garden where rot was prevalent might develop this disease in transit, but this usually will be noticed upon opening the package.

After ordering the irises a bed should be prepared so that no time might be lost after they are received. The soil should be well spaded and raked and some fertilizer added if necessary. Fresh manure or other decaying vegetable matter should not be incorporated with the soil, at least not in the upper layer where the rhizomes will be planted. Decaying vegetable matter in contact with the rhizomes induces rot. Bone-meal is a good fertilizer to use, this being worked into the soil before planting and in subsequent seasons.

The foregoing discussion considered only the bearded irises, but there are other irises that may be grown in this climate. A number of species are listed in various catalogues and some of them can be planted in swampy places. The yellow *Iris pseudacorus* grows well in the garden with its roots partly submerged. There are no uniform lists of named Japanese irises, but these can be purchased at reasonable prices in mixed colors. For best results the Japanese and also the Siberian irises should have a moist situation, but if this is not possible they still can be grown in the average garden if supplied with plenty of water.

Upon opening a package of irises they will be found labeled with wooden or metal tags fastened to the foliage or rhizome. Others will have wooden stick labels and each variety wrapped separately. Still others will have the name written on the leaves which is legible for a time. Whatever the method

the grower has used, the amateur, upon receiving the plants, should adopt some uniform system of labeling and should make a diagram of his garden showing the exact location of every iris. Labels are frequently lost or pulled out, and nothing is so vexing as to have a fine iris in a garden and not know its name. Unless one knows from whom the iris was received, it sometimes takes years to have the variety properly identified. A convenient way of labeling irises is to attach the wooden or metal labels to stout eighteen-inch wire stakes. Such labels are inconspicuous and yet they are easily found and read. It is disagreeable to search around the base of an iris plant, wet with dew, for some small, mud-spattered label difficult to read. Moreover, in replacing, such labels are frequently put to another plant.

The following list of irises is compiled with the hope that it will serve those who wish to start a collection of named varieties. The majority of these will be in bloom in the Garden this spring, and as many of these varieties as possible will be shown at the iris show in May. In this list the number preceding the variety name is the percentage rating of the American Iris Society, very few irises rating higher than 90. Following the variety, in parentheses, is the name of the firm or individual originating or introducing the iris and the first year it was placed on the market. Below will be found the abbreviations of the names of the originators. The color descriptions of many of the varieties are according to Ridgway's "Color Standards and Nomenclature." The prices following the varieties are only approximate at the present time, and when consulting catalogues it will be found they will vary considerably. It might be stated that catalogues that list irises so very much cheaper than the average are from firms or individuals almost unknown to the iris world and frequently cannot supply some of the irises when ordered. The result is that the varieties wanted most must again be ordered from some other firm and the best time for planting irises that season will have passed. It is also well to indicate on the iris labels or chart of the garden the firm from which the iris was purchased, so that, should the variety not be true to name, the firm making the

ZWANENBURG
RHEIN NIXE

MARSH MARIGOLD
LORELEY

ZWANENBURG
RHEIN NIXE

MARSH MARIGOLD
LORELEY

MONSIGNOR
JUNIATA

B. Y. MORRISON
PARC DE NEUILLY

MONSIGNOR
JUNIATA

B. Y. MORRISON
PARC DE NEUILLY

error can be held accountable. It is disagreeable to discover that one has received an inferior variety after having paid a good price for a new iris. Some iris lists guarantee their stock true to name and others state they will cheerfully correct any errors.

ABBREVIATIONS OF NAMES OF ORIGINATORS

Bliss—A. J. Bliss, Morwellham, Tavisstock, Devon, England.
Cay.—Cayeux & Leclerc, Paris, France.
Den.—F. Denis, Balaruc-les-Bains, Herault, France.
Farr—B. H. Farr, Wyomissing, Pa.
Fos.—Sir Michael Foster, Shelford, Cambridge, England.
G. & K.—Goos & Koenemann, Niederwalluf, Germany.
Hort—Sir Arthur Hort, Hurstbourne Tarrant, Hants, England.
Ken.—A. Kennicott, near Chicago, Ill.
Lmn.—Lemon, Belleville, France.
Mil.—Millet & Fils, Bourg-la-Reine, Seine, France.
Mohr—Wm. Mohr, Mt. Eden, Calif.
Per.—Amos Perry, Enfield, Middlesex, England.
Sal.—John Salter, Hammersmith, England.
Sass—H. P. Sass, Omaha, Neb.
Shull—J. M. Shull, Chevy Chase, Md.
Sturt.—Miss Grace Sturtevant, Wellesley Farms, Mass.
Verd.—Eugene Verdier, France.
Vilm.—Vilmorin Andrieux & Cie, Paris, France.
Wmsn.—E. B. Williamson, Bluffton, Ind.
Yeld—George Yeld, York, England.

LIST OF REPRESENTATIVE IRIS

79	Albert Victor (1885)—S.[1] pallid blue-violet, F[2] pallid violet. An old but good variety	$ 0.25
89	Alcazar (Vilm. 1910)—S. light mauve, F. cotinga purple. Pistil pinard yellow. Beard capucine yellow. Veining mahogany red	1.00
94	Ambassadeur (Vilm. 1920)—S. dark lavender, base and edge of standards primuline yellow. F. blackish purple. Style branches pinard yellow, livid brown and light lobelia violet	3.00
83	Ambigu (Vilm. 1916)—Reddish purple flower difficult to describe	2.50
84	Anna Farr (Farr 1913)—White, frilled violet	2.00
86	Anne Page (Hort 1919)—S. & F. light violet. Beautiful in form and color	10.00

[1] S = Standards.
[2] F = Falls.

83	Archeveque (Vilm. 1911)—S. light hortense violet, F. rich blackish purple	$0.50
	Argynnis (Wmsn. 1925)—S. strontian yellow, F. dark violet carmine. Tall and strong grower, well branched	5.00
87	Avalon (Sturt. 1918)—S. & F. light mauve. A very beautiful iris	8.00
80	Azure (Bliss 1918)—S. lavender-blue, F. violet-blue	2.50
94	Ballerine (Vilm. 1920)—S. light blue-violet, F. deeper blue-lavender. A fine large flower	4.00
72	Bluet (Sturt. 1918)—S. & F. pallid bluish violet. Beard fades to white. A small but beautiful iris	1.00
	Bruno (Bliss 1922)—S. bronze and lavender-violet, yellow at base, F. deep red-purple	35.00
85	B. Y. Morrison (Sturt. 1917)—S. pale lavender-violet, F. mulberry purple with lavender border	2.00
75	Caprice (Vilm. 1904)—S. Mathews' purple, F. Rood's violet	.25
	Cardinal (Bliss 1922)—Dominion race. S. lavender, F. prune purple. A very rich and beautiful flower	20.00
71	Celeste (Lmn. 1855)—S. pale wistaria violet, F. light lavender-violet	.25
86	Cluny (Vilm. 1920)—A pale lavender-violet flower	2.00
80	Col. Candelot (Mil. 1907)—A smoky coppery red flower, difficult to describe	1.00
	Colias (Wmsn. 1925)—A very good and beautiful yellow	1.00
80	Dalila (Den. 1914)—Medium-sized flower with S. cream with traces of pink, F. red purple. An interesting color combination	1.50
83	Dejazet (Vilm. 1914)—Reddish violet, orange towards center	1.00
82	Delicatissima (Mil.)—A beautiful pink-toned iris	2.00
83	Dimity (Bliss 1919)—A white iris with lavender penciling on ruffled standards and lavender veining on haft of falls	1.50
85	Dream (Sturt. 1918)—Perhaps the best pink iris	3.00
86	Edouard Michel (Verd. 1904)—A larger Caprice	2.00
	E. H. Jenkins (Bliss 1919)—A good lavender-blue iris	3.00
78	Eldorado (Vilm. 1910)—S. light amparo purple shading to light cadmium on haft, F. amethyst violet. An interesting and unique color combination. Rather weak stems	.50
80	Fairy (Ken. 1905)—White with shading of blue. Very fragrant	.25
70	Flavescens—An old pale yellow variety	.25
76	Florentina—Another old variety. Flowers almost white with just a trace of lavender	.25
89	Georgia (Farr 1920)—S. & F. cattleya rose	3.00
	Gold Imperial (Sturt. 1924)—A good deep yellow	15.00

WHITE KNIGHT
LA NEIGE

FAIRY
INGEBORG

ISOLINE
HER MAJESTY

QUEEN CATERINA
MAGNIFICA

85 **Grevin** (Vilm. 1920)—S. & F. reddish violet. Slightly taller than Opera which it resembles..... $2.00
73 **Her Majesty** (Per. 1903)—An old but still a good pink iris. Heavily veined..... .25
77 **Ingeborg** (G. & K. 1908)—The first of the white irises to bloom. An intermediate..... .25
79 **Iris King** (G. & K. 1907)—S. buff-yellow, F. ox-blood red .50
86 **Isoline** (Vilm. 1904)—S. pale rose-purple, lighter towards center. F. Chinese violet and russet-vinaceous. A tall and pleasing iris..... 1.00
80 **Jacquesiana** (Lmn. 1840)—S. lilac-red and bronze, F. dark reddish purple..... .35
78 **Jeanne d'Arc** (Verd. 1907)—White with lilac penciling.. .50
81 **Juniata** (Farr 1909)—A large lavender-blue flower..... .35
84 **Kashmir White** (Fos. 1913)—A tall white variety..... 4.00
83 **La Neige** (Verd. 1912)—A dwarf, but good white variety with characteristic horizontal falls..... 1.50
89 **Lent. A. Williamson** (Wmsn. 1918)—S. lavender-violet, F. velvety purple. A good strong iris very easily propagated 1.00
91 **Leverrier** (Den. 1917)—A flower of purple and violet hues and very large..... 4.00
82 **Lohengrin** (G. & K. 1910)—S. light mauve, F. slightly deeper. Beard almost white..... .35
79 **Loreley** (G. & K. 1909)—S. Martius yellow, F. raisin purple ..... .25
91 **Magnifica** (Vilm. 1920)—A very large flower. S. light mauve, F. violet with shadings of pink..... 3.00
81 **Ma Mie** (Cay. 1906)—White frilled violet..... .75
87 **Marsh Marigold** (Bliss 1910)—S. golden-yellow, F. rich purple-brown 2.00
78 **Mary Williamson** (Wmsn. 1921)—S. white, F. purple center with white border. A good variety for landscape massing..... 5.00
85 **Medrano** (Vilm. 1920)—A large-flowered, smoky, dark red and mauve iris. Very interesting..... 2.50
83 **Merlin** (Sturt. 1918)—S. light mauve, style buff, F. pansy-purple 1.00
Midwest (Sass 1922)—A white iris flushed with rose.... 3.00
87 **Mlle. Schwartz** (Den. 1916)—Pale mauve. A wonderfully large and beautiful variety..... 3.00
84 **Mme. Cheri** (Sturt. 1918)—Ageratum violet with shadings of light cadmium..... 2.00
86 **Mme. Durrand** (Den. 1912)—Very beautiful buff with lilac and amber shadings. A wonderful flower difficult to describe..... 5.00
90 **Moa** (Bliss 1919)—Dominion race. S. violet, F. very rich pansy-violet 35.00
85 **Moliere** (Vilm. 1920)—S. mauve, F. dark violet..... 2.00

84	**Monsignor (Vilm 1907)—S. mauve, F. cotinga purple, lighter towards edge**	$0.35
	Morning Splendor (Shull 1923)—A fine, rich, red-purple iris	10.00
	Mother of Pearl (Sturt. 1921)—A wonderful iris of pale bluish lavender	8.00
82	**Nancy Orne (Sturt. 1921)—S. rose-purple, F. deeper. Yellow towards center of flower**	2.00
	Ochracea caerulea (Den. 1919)—S. yellowish buff with flush of blue through center. Falls blue with a border of buff. An odd but pleasing iris	2.50
87	**Opera (Vilm. 1916)—A deep, red-violet iris**	2.00
88	**Pallida Dalmatica—S. & F. lavender. An old, but one of the best irises**	.35
81	**Parc de Neuilly (Verd. 1910)—Plum purple flowers**	.50
79	**Parisiana (Vilm. 1911)—S. white-dotted lilac-purple, F. white, frilled lilac at edge**	.50
89	**Phyllis Bliss (Bliss 1919)—S. & F. rosy lavender. One of the best lavender-pink irises**	3.00
	Prince Lohengrin (Mohr 1923)—Mauve-pink. White through center	2.00
	Prospero (Yeld 1920)—A very large violet bicolor. Considered a good iris	3.00
	Ramona (Mohr 1922, Sturt. 1924)—Petunia violet flushed with orange-buff	5.00
84	**Rhein Nixe (G. & K. 1910)—S. white, F. pansy-violet with pale blue edge**	.50
82	**Roseway (Bliss 1919)—A better Queen of May**	1.00
83	**Seminole (Farr 1920)—S. dark violet-rose, F. velvety crimson. One of the best red irises**	2.00
87	**Shekinah (Sturt. 1918)—One of the best tall pale yellow irises**	2.00
81	**Sherbert (Sturt. 1918)—Ecru shaded with purple. A very tall grower, profuse bloomer. Stalks frequently crooked**	1.00
84	**Sindjkhat (Sturt. 1918)—S. and F. lavender with buff. A very good iris, rapid grower, profuse bloomer, flowers of unusually fine substance**	1.00
85	**Sweet Lavender (Bliss 1919)—Pink and blue-lavender. Very beautiful**	2.00
84	**Troost (Den. 1908)—Rose colored, the falls veined**	1.00
84	**Virginia Moore (Shull 1921)—A yellow iris**	2.00
	Wild Rose (Sturt. 1921)—A small beautiful light pink iris	8.00
	Wm. Mohr (Mohr)—Ground color white-veined manganese violet. Beautifully shaped and colored	....
	Zouave (Vilm. 1922)—A good plicata	2.00
85	**Zwanenburg (Den. 1909)—An interesting flower of peculiar greenish yellow and tan shadings**	1.50

NOTES

Mr. G. H. Pring, Horticulturist to the Garden, acted as judge and as a member of the committee of arrangements at the National Flower Show at Kansas City, March 21-29.

Mr. Pring will sail, April 3, for Europe, where he will make a study of botanic gardens and purchase varieties of orchids not in Missouri Botanical Garden collection.

Dr. George T. Moore, Director of the Garden, gave an illustrated lecture, March 13, before the St. Louis Business and Professional Women's Club, at the Second Presbyterian Church, on "Cultivating a Garden"; and on March 26, spoke before the St. Louis Woman's Club on "What Goes on in the Soil."

Mr. G. H. Pring, Horticulturist to the Garden, acted as judge of the school garden exhibits at the Cleveland Flower Show, March 28, and in the evening gave a stereopticon lecture on "Cultivating and Collecting Orchids."

The November, 1924, number of the Bulletin of the Garden Club of America contains an article on "The Feeding of Plants," and the January, 1925, number, one on "Fertilizing Lawns," both by Dr. George T. Moore, Director of the Garden.

Dr. Edgar Anderson, in charge of the School for Gardening, spoke before the Izaak Walton League, of Webster Groves, March 10, on "Metropolitan Parks;" and before St. Andrews Brotherhood, March 15, on "The Life of the Bumble-bee."

Mr. G. H. Pring's lecture, "Collecting Orchids in South America," was given before the Springfield Garden Club, Springfield, Illinois, February 24; the Men's Club of the Clifton Heights Presbyterian Church, March 3; the Peabody School Patrons' Association, the morning of March 11; the pupils of the Harris Teachers' College, the afternoon of March 11.

Dr. Hermann von Schrenk, Pathologist to the Garden, has given the following addresses recently: January 13, "Preservation of Forest Products," before the New England Railroad Club, at the Copley-Plaza Hotel, Boston; January 30, "Forestry, Pathology, and Engineering," Jane Aldred lecture at the Massachusetts Institute of Technology, Cambridge, Mass.; January 19, "Forest Conservation from

the Standpoint of the Consumer,'' before the Southern Conservation Congress, Little Rock, Ark.

STATISTICAL INFORMATION FOR FEBRUARY, 1925

GARDEN ATTENDANCE:

Total number of visitors..... 6,459

PLANT ACCESSIONS:

Total number of plants received as gifts..... 12
Total number of seed packets received in exchange... 180

LIBRARY ACCESSIONS:

Total number of books bought..... 148
Total number of books and pamphlets donated..... 700

HERBARIUM ACCESSIONS:

By Gift—

Anderson, Mrs. E.—*Porella pinnata* from St. Louis County, Missouri 1
Chamberlain, Prof. Charles J.—*Cycads* from Mexico and the West Indies..... 5
Epling, Dr. Carl C.—Plants of California..... 2
Florists' Publishing Company—Plants of Louisiana..... 1
Martin, Professor G. W.—*Stereum rufum* of Yellowstone National Park..... 1
Stewart, Dr. F. C.—*Exidia glandulosa* Fr. and *E. lurida* Schw. from New York..... 2

By Exchange—

Botanic Garden, University of Cluj, by Prof. A. Borza—Florae Romaniae Exsiccatae, Cent. IV and V, Nos. 301-500 200
Boyce, Dr. J. S.—Fungi of Washington, Oregon, and California 13

By Purchase—

Bartholomew, Elam—N. A. Uredinales, Centuries 32-33, Nos. 3101-3300, inclusive.....200
Dutton, D. Lewis—Plants of Vermont.....240
Fisher, George L.—Plants of Mexico.....118
Bush, B. F.—Plants of Missouri.....191

Total 974

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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OF THE MISSOURI BOTANICAL GARDEN

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Missouri Botanical Garden Bulletin

Vol. XIII APRIL, 1925 No. 4

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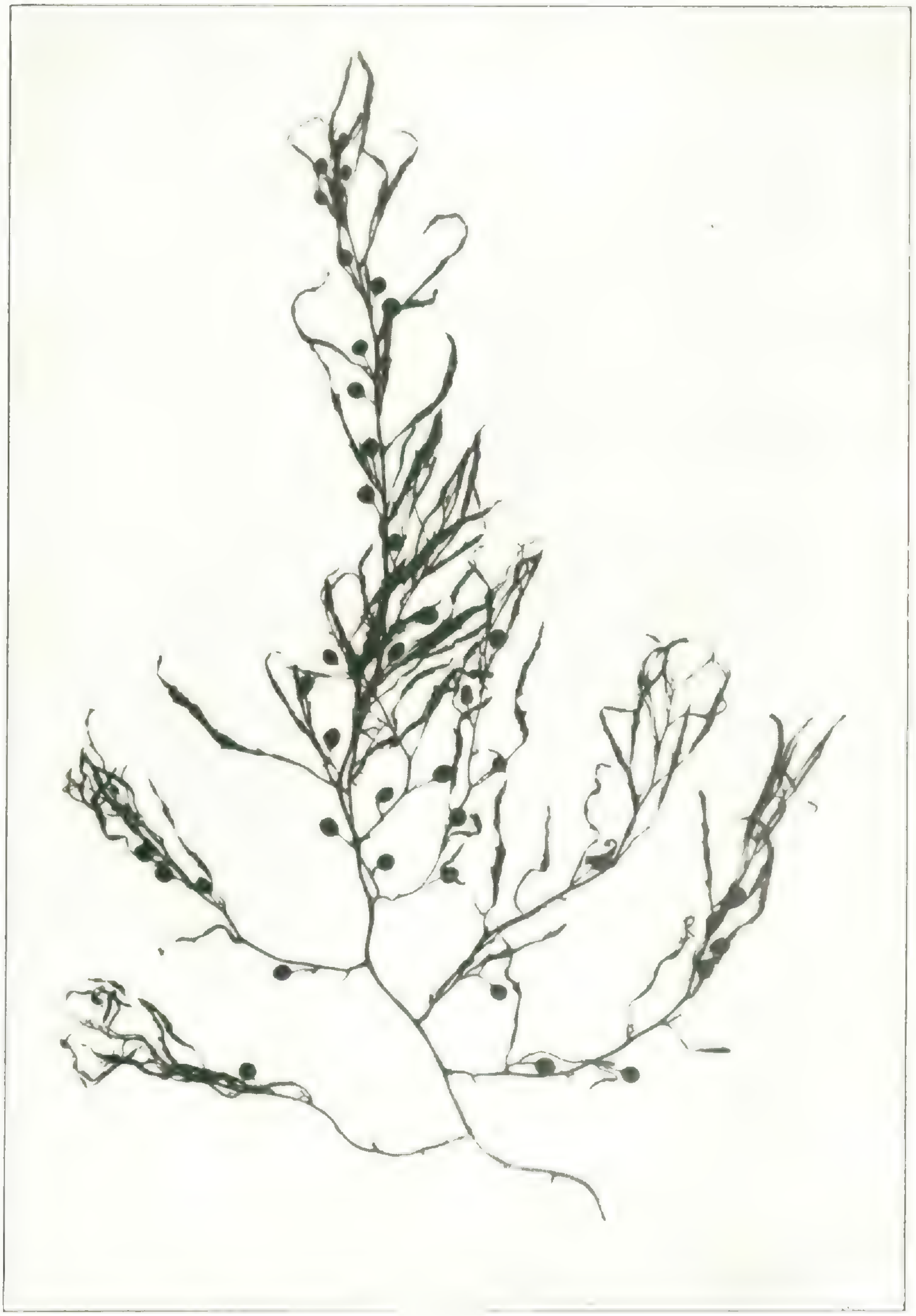

SARGASSUM NATANS.

The gulf-weed which constitutes the majority of the Sargasso Sea. The round berry-like bodies are floats and not fruits.

Missouri Botanical Garden Bulletin

Vol. XIII APRIL, 1925 No. 4

THE SARGASSO SEA

Ever since that morning, in September, 1492, when Columbus sailed into masses of floating sea-weed in latitude 28° N., 58° W., the Sargasso Sea has given rise to the wildest speculation as to its origin and cause. Writers, both in fiction and for the movies, have located their scenes here, for the popular mind has always been fascinated by the air of mystery which seemed to cling to this part of the Atlantic. The expedition recently fitted out to study seriously the life of the Sargasso Sea has again aroused interest on the subject, and many problems connected with the vast marine pasture will be solved. One question, however, which has always puzzled the botanist will probably not be answered even by this admirably equipped party, and that is the original source of the plant growth which constitutes the greater portion of the mass of marine algae.

One of the earliest and certainly one of the best accounts of the Sargasso Sea is by Professor William Henry Harvey, who was keeper of the herbarium of the University of Dublin and who came to this country in the early fifties to deliver a course of lectures on the algae before the Lowell Institute of Boston and the Smithsonian Institution at Washington. Later the Smithsonian Institution published a volume by Professor Harvey under the title "Nereis Boreali-Americana, or Contributions to a History of the Marine Algae of North America," which was the first systematic account of the marine flora of this country. The following quotation is taken from his work:

"One remarkable species of the genus *Sargassum* has long been famous by the name of Gulfweed or Sargazo (sea-lentils), under which most voyagers since the days of Columbus have spoken of it. That great discoverer was the first to encounter it in modern times (16th September, 1492) and with his account we are therefore most familiar; but possibly the weedy sea which Aristotle speaks of as having been met with by the Phoenicians, at the termination of their voyage, may have been an early discovery of the same bank. It is curious that the great bank which extends between the 20th and the 45th parallels of north latitude and in 40° W. from Greenwich, appears to occupy the same position at the present day as it did in the days of Columbus. Between this bank and the American shores, various smaller strata and detached masses of seaweed occur, being thrown into this portion of the ocean by the eddy caused by the sub-circular motion of the great oceanic currents. The whole of this immense space of ocean, which is reported to be thickly covered with seaweed, is computed by Humboldt at upwards of 260,000 square miles, an area almost six times as large as Germany; but it is not to be supposed that all this space is *equally* clothed with floating verdure. In many places the weed occurs in distant and narrow ridges, leaving spaces of clear water between. This portion of the Atlantic seems to be the chief *settlement* of the *Sar. bacciferum*, but straggling specimens occur in the Pacific and Indian Oceans, and on the shores of Australia and New Zealand; and some few, carried northward by the Gulf Stream, reach the northern shores of Europe in safety.

"Naturalists have been puzzled to account for the origin of the Gulfweed, and formerly it was supposed to be altogether derived from the Gulf of Mexico; being torn off the shores of the Florida reefs and keys and carried to sea with the great current. It is possible (and indeed probable) that the *origin* of the present floating banks may have been partly of this nature, but it is most certain that the great masses of the weed that are at present found floating have had no such immediate parentage, but are produced on the surface of the ocean on which they float. Whoever has picked up the plant

at sea, on any genuine portion of the bank, must have seen that it was in perfectly fresh and growing state, and if he have looked at his specimen carefully, he will probably have observed that different parts of the same specimen are of different ages; that though there was no apparent root, yet that toward the center of the mass a small portion of stem was of a much darker color than the rest, and possibly covered by parasitic incrustations; and that all the branches springing from this central piece were successively more and more delicate and of paler colour, and evidently in a young and sprouting state. Such a specimen is clearly in vigorous life, yet it has no *root*. But the absence of root is a matter of very trivial moment in a seaweed; for we must bear in mind that the roots of Algae are merely holdfasts, intended to keep them from being washed off the rocks on which they grow. And in a plant capable of enduring extensive change of place, like this Sargassum, the root is the part which may be most readily dispensed with. No doubt the specimen under examination originated in a little branch accidentally broken from a neighboring mass, and which being thus cast adrift, continued to push out new branches and leaves. In this manner, by the continual breaking up of old fronds and the continued growth of their broken parts, the floating masses spread over the surface of the sea.

"In this floating state the species never forms proper fructification. There is, therefore, no growth from spores. The supply of plants is consequently kept up and extended by the constant development of buds or *gemmae*, originating in broken fragments of branches. I have taken some pains to examine numerous specimens, picked up on various parts of the bank, while fresh from the sea, and have in general been able to convince myself that the tuft under examination had originated in a fragment of an older tuft.

"This process of growth by breakage must have gone on for Ages; from that early time when the first individuals were brought from some unknown rocks by the currents of the ocean. Humboldt indeed conjectures that between the parallels of 20° and 45° there is an immense bank from which the supply of Sargassum is constantly derived; but

such a bank, if covered by only as much water as the *greatest* depth at which any Fucaceous plant is known to grow, could scarcely have escaped the notice of voyagers. And the aspect of *Sargassum*, with its innumerable floating bladders, shows that it was not intended to vegetate at any great depth; for we invariably find the air-vessels most numerous in species which rise to the surface, and altogether absent in those which are deeply submerged."

Alexander Agassiz, in 1888, in writing of the Sargasso Sea, said:

"The Sargasso Sea of the North Atlantic covers a rather indefinite area between 22° and 36° N., and according to the statements of the older navigators, the amount of Sargassum to be met with varies from occasional patches to masses large enough to impede the progress of sailing vessels. The Sargassum probably changes its position constantly, according to the seasons, the currents, and the direction of the wind; but within the area bounded by the Gulf Stream on the West, the equatorial current on the South and the return current from the Azores and Canaries the Sargassum has always been found in larger or smaller quantities."

Botanists have always been interested in this great mass of vegetation, most of them contending that the Sargasso Sea consisted of algae drawn from their natural habitat on the shores of the West Indies, from which they were carried by ocean currents and winds to the Sargasso Sea, where they soon decayed and disappeared. More recently, however, the conclusion has been definitely reached that the algae, whatever their remote origin, are to be regarded as floating perennials which by continuous growth replace decaying parts and perpetuate themselves vegetatively rather than by forming any sort of fruit or reproductive body. That the floating Sargassum must originally have come from a plant growing attached, as all of the other sargassums do, is presumed, but no one has satisfactorily shown just how this has come about, and any suggestion as to the species which gave rise to the form now known as *Sargassum natans* (*S. bacciferum*), and which constitutes the great mass of the Sargasso Sea has never been widely accepted.

PART OF GARDEN'S ORCHID EXHIBIT AT NATIONAL FLOWER SHOW

PACKING CASE DESIGNED FOR SHIPPING BASKETS OF EPIPHYTIC ORCHIDS

THE GARDEN'S EXHIBIT AT THE SEVENTH NATIONAL FLOWER SHOW

The seventh National Flower Show was held in Kansas City, March 21-29, at Electric Park. This amusement park was selected after the public auditorium was totally destroyed by fire a few weeks prior to the opening of the show. The orchid displays at the flower shows held in the East are quite a feature, and at the solicitation of Chairman George Asmus, of Chicago, and the local chairman, William L. Rock, the Garden agreed to send a display in order that these choice blossoms might be represented at the Kansas City show.

No other plant is more difficult to transport than the orchid, so that the final decision to send a collection to the National Flower Show depended upon being able to devise suitable shipping cases. Previous experience has proved that 75 per cent of the flowers may be ruined when packed by the usual method. Considerable study was given to the question, and the method used was so successful that not a single floral segment of the delicate flowers was broken during transit. Consequently it seems desirable that details of the method used be given in order that others may have the benefit of our experience. The shipping box (plate 18) was so constructed as to permit one end being entirely taken out, by removing two long rods which penetrated through six butt hinges, three on either side. The top of the box was permanently fastened, with the exception of the two feet next to the removable end. This part of the top, being hinged to the permanent end, could be lifted in order to permit the removal of the end. The inner crate which slipped into the packing box was of two types, one for packing of wooden baskets containing epiphytic plants, the other with cut-in holes to fit the terrestrial plants in pots. Each basket or pot was securely fastened by a series of turn-buttons, one holding two pots. The plants and flowers were wrapped with packing and tissue paper and placed in the crate specially designed to receive them. After a double row was in place they were fastened with the turn-button and another double row packed and fastened until all were held secure.

The crate was then ready to be pushed into the shipping box. A cross-bar attached to the permanent end of the box fitted just above the end of the crate and the removable end was likewise provided with a similar cross-bar which, when fitted into the butt hinges, held the other end of the crate. The two rods were pushed through the hinges, thus holding the end in position; the hinged top was pulled down and fastened by hinged hasps fitted over the eyes on the removable end. A rod passing through the eyes held everything secure and this was padlocked in place. Rope handles on the ends and drop handles on each side made the box easily lifted.

The ease of unpacking such a container is another point in its favor. At Kansas City the crates were carried by trucks to the assigned display space. The box was here unlocked, the top section opened, the removable end taken out, and the inside crate easily pulled out and placed upon the shipping box. Here the plants could be readily selected for arrangement according to size, number of flowers, etc. Afterwards the empty crate was replaced, all packing being placed within the box and locked. The convenience of being able to find one's own packing, stakes, etc., after the show can be appreciated by one who has had experience in exhibiting at flower shows. Another convenience was a small built-in tool chest at one end of the crate. This held such necessary articles as hammer, pliers, nails, pins, wire, twine, labels, etc., things which are usually at a premium at all exhibitions.

The Garden exhibit was displayed in two separate sections, one at each side of the cascades upon which the Roland acacias were staged. All epiphytic orchids were fastened on birch trees in imitation of their natural habit of growth. The terrestrial plants were arranged in a mound below. The exhibit consisted of *Cattleya Schroederae* in quantity, *C. Skinneri*, *C. Dusseldorffii* var. "Undine," Brasso-Cattleya, Brasso-Laelio-Cattleya, Laelio-Cattleya, and *Vanda tricolor*, etc. An unusually good form of *Laelio-Cattleya luminosa* var. *aurea* was shipped in bud and placed in the greenhouses of W. J. Barnes, where it opened. This formed a special feature for the middle of the week. The slipper orchids included 150 plants in thirty varieties. Several botanical species were also

PACKING CASE FOR POTS OF TERRESTRIAL ORCHIDS

included. The two exhibits occupied over a hundred square feet each. The exhibit was awarded the American Orchid Society's gold medal and the National Flower Show gold medal.

LIST OF MISSOURI WILD FLOWERS ACCORDING TO TIME OF BLOOMING

MARCH

ACER SACCHARINUM (Silver or soft maple). March-April.
Leaves deeply 5-lobed, silvery white beneath; flowers in clusters or rarely, yellowish, very showy, appearing before the leaves.
Found along river and creek banks. Common here.

ACER RUBRUM (red maple). March-April.
Tree with reddish twigs; leaves varying greatly in shape and turning bright crimson in early autumn; flowers scarlet, crimson, or rarely, yellowish, very showy, appearing before the leaves.
Found in swamps and wet woods. Not common here.

ADELIA ACUMINATA (swamp privet). March-April.
Shrub 5-10 feet high; leaves smooth, thin, pointed at both ends; flowers small, yellow, in clusters.
Found on wet river banks and in swamps.

ALNUS RUGOSA (smooth alder). March-April.
Shrub 5-20 feet high; bark smooth; leaves green, both sides finely serrate.
Found in wet soil along river and creek banks, borders of lakes, etc. Not very common here.

AMELANCHIER CANADENSIS (shad bush or service berry). March-May.
Shrub or small tree; leaves, when young, folded lengthwise and brownish purple, cordate at base; flowers large, white, in racemes; fruit globose, crimson or purplish.
Found in dry open woodlands.

ANEMONELLA THALICTROIDES (rue anemone). March-June.
Stem slender, 4-8 inches high, from a cluster of tuberous roots; flowers white or sometimes pinkish, several in a cluster.
Common in woods.

ASIMINA TRILOBA (North American papaw). March-April.
Small tree; leaves large, thin, pointed; flowers dull purple, veiny, stamens numerous; fruit large, pulpy, edible in the fall.
Found on banks of streams in rich soil.

BENZOIN AESTIVALE (spice bush). March-April.
Shrub, with yellow flowers in umbel-like clusters, appearing before the leaves; fruit, a red berry.
Found in damp woods, river bottoms, etc.

CAPSELLA BURSA-PASTORIS (shepherd's purse). March-October.
Petals small, white; stem-leaves arrow-shaped, sessile, very variable in foliage and shape of pod.
A common weed in yards, lawns, etc. Naturalized from Europe.

CLAYTONIA VIRGINICA (spring-beauty). March-May.
Leaves 2; flower stems 6-8 inches high; flowers white or pink with darker pink veins.
Found in moist rich soil. Common.

CORYDALIS AUREA (golden corydalis). March-May.
Biennial; leafy-stemmed and pale or glaucous, 6-14 inches high; flowers golden yellow.
Found on rocky banks, recent clearings, etc. Not common.

DRABA BRACHYCARPA (short-fruited Whitlow grass). March-May.
Tufted annual 2-5 inches high; stems leafy; basal leaves ovate, sparingly dentate or entire; flowers small, yellow.
Found in dry hills, cultivated fields, etc. Common.

DRABA CUNEIFOLIA (Whitlow grass). March-April.
Annual 4-8 inches high, branching and leafy below; leaves obtuse, dentate towards the top; flowers white.
Found in limestone glades, etc. Not common.

ERIGENIA BULBOSA (harbinger-of-spring or pepper-and-salt). March-April.
A small smooth perennial, with simple stem, bearing 1-2 leaves and small umbels of white flowers; root, a small tuber.
Found in rich shaded woods, bottoms, etc.

ERYTHRONIUM ALBIDUM (white adder's-tongue or dog's-tooth violet). March-May.
Leaves of the flowering plants 2, mottled or green all over; flower white or bluish; stems 6-8 inches high.
Found in rich moist woods, mostly in river or creek bottoms. Rather common.

EUPHORBIA COMMUTATA (tinted spurge). March-July.
Stems branched from a decumbent base; leaves obovate, obtuse, umbel 3-forked.
Found on rich shady slopes.

FRAXINUS QUADRANGULATA (blue ash). March-April.
Tree; young branches square; leaflets 7-11, short-stalked, sharply serrate, green on both sides. Inner bark colors water bluish.
Found on dry limestone bluffs and hillsides.

HEPATICA ACUTILOBA (sharp-lobed liverleaf). March-April.
Leaves with 3 ovate and pointed lobes, old ones sometimes spotted, persistent through the winter, new ones appearing later than the flowers; flowers white or purplish; roots fibrous.
Found on rich north hillsides or banks. Not common in our locality now.

HOUSTONIA MINIMA (least bluets). March-April.
Much-branched and spreading, 1-3 inches high; earlier flower stems longer than the later ones.
Found in dry hills and meadows. Rather common.

MERTENSIA VIRGINICA (Virginia cowslip or blue-bell). March-May.
Perennial herb 1-2 feet high; whole plant smooth, pale green, erect; leaves large, entire; flower light blue, rarely white.
Found in rich soil, river and creek bottoms, etc.

OXALIS CORNICULATA (lady's sorrel). March-November.
Perennial, from creeping rootstalks; leaflets green or often purplish.
Found in dry or moist open places.

PLANTAGO CORDATA (heart-leaved water plantain). March-July.
Tall smooth plant; leaves fleshy, heart-shaped or round-ovate, long-stemmed, reddish-colored when young.
Found along streams and in wooded swamps. Not common locally.

RHUS CANADENSIS (fragrant sumac). March-April.
Small shrub; leaves soft-pubescent when young, 3-foliate; flowers pale yellow, appearing before the leaves.
Found on dry rocky banks. Common.

STELLARIA MEDIA (common chickweed). March-December.
Tufted annual, much branched, 4-5 inches high; flowers small, white, in terminal leafy clusters or singly in the arils of the leaves.
Naturalized from Europe, becoming a weed in lawns.

ULMUS AMERICANA (white elm). March-April.
Large tree with gray flaky bark; flowers in clusters appearing before the leaves; fruit with margins densely ciliate.
Found mostly in wet bottom land. Our most common elm.

ULMUS FULVA (red or slippery elm). March-April.
Tree attaining a height of 70 feet; bark rough, gray, fragrant, especially in drying; winter buds large, brown; fruit margins smooth; flowers appearing before the leaves.
Found in rich soil, hillsides, bluffs, etc.

VERONICA ARVENSIS (common speedwell). March-September.
Annual herb 4-5 inches tall; flowers small, white, in the axils of the leaves, hairy.
Found in cultivated ground and in rocky woods. Naturalized from Europe.

APRIL

ACER SACCHARUM (sugar maple). April-May.
Trees; leaves opposite, palmately lobed, 3–5 lobed; flowers drooping, appearing with the leaves.
Found in rich soil. Common here.

ACTAEA ALBA (white baneberry). April-June.
Perennial; 2-3 ternately compound leaves, leaflet sharply cleft and toothed; flowers white, in racemes; fruit the size of a pea, white; pedicels red.
Found in rich woods. Not common.

AESCULUS GLABRA (Ohio buckeye). April-May.
Trees; leaves opposite, digitate; fruit a leathery pod, 3-celled and 3-seeded; seed large with a large round pale scar; flower pale yellow, petals 4, upright.
Found along river and creek banks. Rather common.

AMSONIA TABERNAEMONTANA (Amsonia). April-July.
Perennial; leaves alternate; flowers pale blue, in terminal panicled cymes; juice milky.
Along river and creek banks, on gravel bars, etc. Rather common.

ANTENNARIA PLANTAGINIFOLIA (everlasting). April-June.
Perennial white-woolly herbs with entire leaves; flowers white in corymbose heads, 6-8 inches high.
Found in dry poor soil. Common.

AQUILEGIA CANADENSIS (wild columbine). April-July.
Perennial herbs 2-3 feet high, with ternately compound leaves; flowers scarlet, yellow inside; pod 5-celled, many seed.
Found on rocky cliffs, etc. Not very common.

ARABIS LAEVIGATA (smooth rock cress). April-May.
Biennial herbs 2-3 feet high, erect, leafy-stemmed, smooth and glaucous, partly clasping at the base; flowers small, whitish; pods long and flattish; seeds broadly winged-margined.
Found in dry rocky limestone glades, etc. Rather common.

ARABIS LYRATA (lyre-leaved rock cress). April-September.
Biennial here, perennial in the South, 1 foot high; lower leaves fiddle-shaped, upper toothed or entire; flowers white; pod slender, flat; seed not winged-margined.
Found on sand hills at Pacific, etc. Not common.

ARENARIA PATULA (Pitcher's sandwort). April-May.
Low herb, branched from the base, 6-8 inches high; flowers white, showy, with 5 petals; pod short.
Found on sand hills, etc. Not common.

ARISAEMA TRIPHYLLUM (Jack-in-the-pulpit). April-June.
Perennial; root, a tuber or corymb; leaves mostly 2, divided in 3 leaflets; spadix club-shaped, shorter than the spathe; fruit, a cluster of scarlet berries.
Found in rich shaded woods. Rather common.

ASARUM CANADENSE (wild ginger). April-May.
Low perennial herbs with aromatic creeping rootstocks; leaves 1 or 2, kidney or heart-shaped; flowers brown-purple on a short stem at the base of the 2 leaves.
Found on rich shaded hillsides. Common.

BAPTISIA BRACTEATA (false indigo). April-May.
Perennial herbs with palmate, 3-foliate leaves, hairy; flowers cream-colored in long racemes; pods pointed at both ends.
Found on dry hills. Not very common.

BETULA NIGRA (red or river birch). April-May.
Trees with reddish twigs; leaves acute at both ends, green above, whitish beneath; staminate catkins at the ends of the branchlets, pistillate ones with the lateral buds along the branchlets; the only local birch.
Found along river and creek banks, swamps, etc. Common.

CAMASSIA ESCULENTA (wild hyacinth). April-May.
Scape 6-10 inches high; leaves onion-like; raceme elongated, flowers pale blue; pods 3-angled; root, a bulb.
Found in limestone glades, etc. Rather common.

CARDAMINE BULBOSA (bulbous cress). April-June.
Smooth upright stems from a tuberous base and slender root-stock bearing small tubers; root-leaves cordate, petioled; stem-leaves scattered, the upper sessile; flowers white.
Found in wet meadows and spring branches, etc. Not common.

CERASTIUM ARVENSE (field chickweed). April-July.
Low tufted herbs 4-8 inches high, downy or nearly smooth; flowers white, petals 2-lobed, or cleft.
Found in dry rocky places, old fields, etc.

CERCIS CANADENSIS (red-bud or Judas tree). April.
Small trees with rounded, heart-shaped leaves; flowers red-purple in umbel-like clusters along the branches of the last or preceding years, appearing before the leaves; pods flat, 2-3 inches long, many-seeded.
Found in rich soil. Common.

CLEMATIS FREMONTII (Fremont's clematis). April-May.
Perennial herb 1-2 feet high; leaves thick, coarsely toothed; flowers solitary, short-stemmed, bluish white; fruit not plumose.
Found in glades, etc. Rare locally.

COLLINSIA VERNA (innocence). April-June.
Small annual herbs 4-8 inches high; flowers blue and white, in the axils of the upper leaves, clasping by a heart-shaped base.
Found in moist rich woods. Rare.

COMANDRA UMBELLATA (bastard toad-flax). April-July.
Rootstock under ground; flowering stems 4-8 inches high, very leafy; flowers greenish white in an umbel-like cluster.
Found in dry open glades, etc. Rather common.

CORNUS FLORIDA (flowering dogwood). April-June.
Small trees; leaves opposite, pointed; flowers greenish in a close cluster, surrounded by a showy white 4-bracted involucre; fruit red, showy.
Found in dry woods. Common now but being badly broken down and injured by automobile parties to the country.

CYNOGLOSSUM VIRGINIANUM (wild comfrey). April-May.

Perennial 1-2 feet high; stem few-leaved, rough, clasping by a heart-shaped base; flowers pale blue in a few-flowered corymb.

Found in rich open woods. Not very common.

DELPHINIUM TRICORNE (dwarf larkspur). April-May.

Root a tuberous cluster; stem simple, 1-1½ feet high; leaves deeply 5-parted, their divisions unequally 3–5-cleft; lobes linear; flowers bright blue or sometimes white.

Found on rich banks, etc. Common.

DENTARIA LACINIATA (toothwort). April-June.

Tuberous-rooted perennial; stems pubescent above; stem-leaves 3, whorled or nearly so, deepely cleft; flowers white or purplish.

Found in rich damp woods. Common.

DICENTRA CUCULLARIA (Dutchman's breeches). April-May.

Low stemless perennial with ternately compound and dissected leaves; scape and slender petioled leaves from a cluster of grain-like tubers in the form of a scaly bulb; flowers white, 2-spurred.

Found in rich woods. Rather common.

DODECATHEON MEADIA (shooting-star). April-May.

Smooth perennial with fibrous roots, a cluster of basal leaves, and naked scape, 1-2 feet high, with an umbel of nodding rose-colored or sometimes white flowers.

Found in open woods, etc. Not common.

ERIGERON PHILADELPHICUS (Philadelphia fleabane). April-August.

Perennial 2-3 feet high; stem leafy, corymbed, bearing a few large heads; leaves thin, clasping by a heart-shaped base, mostly entire; rays numerous, rose color.

Found in yards, fields, etc. Very common.

ERIGERON PULCHELLUS (robin's plantain). April-June.

Hairy perennial, 1-1½ feet high, sending out runners from the base; stem nearly naked above, bearing a few large heads; rays rather broad, light bluish purple.

Found on moist banks, etc. Not common.

EUPHORBIA COROLLATA (flowering spurge). April-October.

Perennial 2-3 feet high, smooth or sometimes sparingly hairy; root deep, running horizontally; leaves lanceolate or linear, smooth, entire; umbel 3–7-forked, the forks again 2 3-forked; involucres long-stemmed, with showy white appendages, like petals.

Found in rich or sandy soil. Rather common.

EUPHORBIA HETEROPHYLLA (various-leaved spurge). April-November.

Annual 1-2 feet high, smooth; leaves alternate, petioled, ovate, fiddle-shaped and toothed or lanceolate and entire, upper usually with a red base.

Found on slopes and rocky soil. Not common.

FRAGARIA VIRGINIANA (wild strawberry). April-June.
Stemless perennials, sending out runners; leaflets of firm texture; flowers white.
Found on old field banks, etc. Common.

FRAXINUS AMERICANA (white ash). April-May.
Trees; branchlets and petioles smooth; leaflets 5-9, pale or pubescent beneath, entire or slightly serrate; fruit marginless below; flowers appear before the leaves.
Found in rich woods, etc. Common.

FRAXINUS LANCEOLATA (green ash). April-May.
Trees with smooth branches; leaflets often wedge-shaped, green on both sides, serrate above the middle.
Found on low grounds along streams, etc. Common.

GERANIUM CAROLINIANUM (Carolina cranesbill). April-August.
Annual, 1 foot high, branched, hairy; leaves about 5-parted, the divisions cut into many parts; flowers small, white or pale pink.
Found in cultivated fields, etc. Common.

GERANIUM MACULATUM (spotted cranesbill). April-July.
Perennial, 1-2 feet high, hairy, erect; leaves about 5-parted, the wedge-shaped divisions lobed at the ends; petals entire, light purple, showy.
Found in rich open woods and on banks, etc. Rather common.

GEUM VERNUM (Spring avens). April-June.
Perennial 1 foot high; stems ascending, few-leaved; root-leaves roundish, heart-shaped, 3–5-lobed; flowers small, yellow.
Found in rich thickets. Not common.

GRATIOLA SPHAEROCARPA (hedge hyssop). April-June.
Perennial 1-3 feet high, smooth, rather stout; leaves lance-ovate, toothed; flowers small, white, in the axils of the leaves.
Found in wet swampy places. Not common.

HELIOTROPIUM TENELLUM (slender heliotrope). April-August.
Annual 4-8 inches high, branched, slender, strigose-canescent; leaves linear with rolled margins; flowers white.
Found in open glades, etc. Not common.

HYDRASTIS CANADENSIS (golden seal). April.
Perennial 6-10 inches high; rootstock yellow, very bitter to the taste; stem simple, bearing 2 leaves at the top, terminated by a single greenish-white flower.
Found in rich woods. Becoming rare now.

IRIS HEXAGONA (southern blue flag). April-May.
Stem round; leaves green, not glaucous, the upper much overtopping the flower; flowers large; pod 6-angled.
Found in swampy places. Rare locally.

KALLSTROEMIA MAXIMA (greater caltrop). April-September.
Annual herbs, branched from the base; flowers small, petals yellow; leaflets 4-6 pairs, grayish-hirsute.
Found on railroad banks, etc. Introduced from the Southwest. Rare.

KRIGIA DANDELION (dwarf dandelion). April-July.
Perennial; roots tuberiferous; scapes leafless, 8-10 inches high; leaves smooth, entire or few-lobed; flowers yellow.
Found on moist sandy hills, etc.

KRIGIA VIRGINICA (dwarf dandelion). April-August.
Annual; scapes several, 1 foot high, becoming branched and leafy; lower leaves entire, upper cut-lobed; flowers yellow.
Found in dry soil, hills, etc. Not common.

LITHOSPERMUM CANESCENS (hoary puccoon). April-June.
Perennial, softly hairy, hoary, 8-10 inches high; leaves roughish; flowers yellow.
Found in glades, etc. Common.

MITELLA DIPHYLLA (miterwort). April-May.
Perennial herbs, hairy, 12-16 inches high; leaves heart-shaped, 3-lobed; stem with 2 opposite leaves, many-flowered; flowers white, in racemes.
Found in moist sandy ledges and banks. Rare.

MOLLUGO VERTICILLATA (carpet weed). May-September.
Prostrate annual; leaves clustered in whorls at the joints; flowers small.
An immigrant from the South. Common in yards, fields, etc.

MORUS RUBRA (red mulberry). April-May.
Trees; leaves heart-ovate, serrate, rough above, sometimes lobed. The only native mulberry here.
Found in rich woods. Common.

NYMPHAEA ADVENA (small yellow pond lily). April-September.
Rootstock creeping; leaves with a deep sinus at the base; flowers small, yellow or sometimes tinged purple.
Found in lakes or ponds. Rare here.

OROBANCHE UNIFLORA (one-flowered cancer-root). April-June.
Herbs; root parasitic; scape one-flowered, leafless; entire plant pale white.
Found in damp woods. Rare.

PARTHENIUM REPENS (creeping parthenium). April-July.
Perennial, 1-2 feet high, from running rootstocks; stems white, hairy, rough; flowers white.
Found in barrens, glades, etc. Rather common.

PEDICULARIS CANADENSIS (lousewort). April-June.
Perennial, hairy; stem simple, 8-12 inches high; leaves scattered along the stem, pinnately parted; flowers greenish-yellow and crimson.
Found in thickets and along banks. Not common.

PHACELIA PURSHII (Pursh's phacelia). April-June.
Annual; stem erect, branched; stem-leaves 5–9-lobed; raceme many-flowered, light blue or sometimes white, showy.
Found in moist rich woods or on banks. Not common.

PHLOX DIVARICATA (wild blue phlox). April-June.
Perennial; leaves opposite, sessile, entire; flowers cymose, blue.
Found in woods and on banks. Very common.

PHLOX PILOSA (downy phlox). April-June.
Stem slender, nearly erect, 8-10 inches high, hairy; leaves linear, pointed; flowers variable, rose-pink or sometimes white.
Found in dry glades, prairies, etc.

POLEMONIUM REPTANS (Jacob's ladder or Greek valerian). April-May.
Perennial with alternate pinnate leaves, smooth; stem weak and spreading, few-flowered; flowers blue.
Found in rich woods and on banks. Not common.

POLYTAENIA NUTTALLII (polytaenia). April-May.
Perennial 2-3 feet high, mostly smooth; leaves pinnate; flowers bright yellow.
Found in barren places. Rather rare.

POTENTILLA CANADENSIS (five finger). April-August.
Perennial, 6-10 inches high, hairy; stems spreading and producing runners which root at the joints; flowers small, yellow.
Found in old fields, meadows, etc. Common.

PRUNUS AMERICANA (wild plum). April-May.
Small trees; leaves narrowly obovate; sharply serrate; flowers white, appearing before the leaves; fruit round, red.
Found in borders of woods, old fields, etc. Common.

PSORALEA PEDUNCULATA (Samson's snakeroot). April-July.
Perennial, 2-3 feet high, slender, branched; leaves 3-foliate, glandular; flowers bluish purple; pods wrinkled.
Found in sandy soil. Rare here.

PYRUS CORONARIA (wild crab-apple). April-May.
Small trees, somewhat armed on the end of the branches; leaves sometimes lobed; flowers pinkish white.
Found in old fields, thickets, etc. Common.

RANUNCULUS FASCICULARIS (tufted buttercup). April-May.
Perennial 4-8 inches high; stems ascending; lower leaves pinnate; flowers yellow; roots fleshy, like tubers.
Found in dry open hills. Rather common.

RANUNCULUS HARVEYI (Harvey's buttercup). April-May.
Biennial 6-12 inches high; root-leaves 3-parted; stems branched above; flowers small, bright yellow.
Found in rocky glades and on hills. Not common.

RANUNCULUS SEPTENTRIONALIS (marsh buttercup). April-July.

Perennial 8-12 inches high; stems hairy, erect in spring but later producing long runners.

Found in moist or shaded places. Our commonest buttercup.

SANGUINARIA CANADENSIS (bloodroot). April-May.

Perennial 2-6 inches high, sending up a palmately lobed leaf and a 1–few-flowered stem; roots thick, juice red-orange; flowers white, showy.

Found in open rich woods. Very common.

SCUTELLARIA PARVULA (small skullcap). April-July.

Perennial 4-8 inches high, pubescent; stems branched and spreading; flowers axillary, blue.

Found in sandy glades, on hills, etc. Rather common.

SENECIO AUREUS (golden ragwort). April-September.

Perennial 1-2 feet high; stems erect from slender rootstocks; leaves slightly woolly; flowers yellow.

Found in wet places. Common.

SENECIO OBOVATUS (round-leaved squaw-weed). April-June.

Perennial 1-1½ feet high, bearing stolons at base; leaves winged-petioled, smooth on both sides; flowers yellow.

Found on limestone ledges, in woods, etc. Common.

SENECIO PLATTENSIS (prairie ragwort). April-June.

Perennial 8-16 inches high; stems branched from base; leaves usually white, woolly beneath; flowers yellow.

Found on dry ledges, in sandy places, etc. Rare.

SMILAX HERBACEA (carrion-flower). April-June.

Stems climbing, not prickly; leaves rounded, mostly heart-shaped, 7–9-veined, smooth; flowers long-petioled, bearing an umbel of 20-30 bad-smelling greenish flowers.

Found in moist rich woods. Rather common.

SPARGANIUM EURYCARPUM (broad-fruited bur-weed). May-August.

Perennial 1-3 feet high; stems leafy, seldom branched; leaves flat and keeled; flowers white; fruit large, bur-like.

Found in swamps, etc. Not common.

STAPHYLEA TRIFOLIA (bladder nut). April-May.

Shrubs 6-10 feet high; leaves opposite, 3-foliate; flowers white, in drooping clusters, appearing with the leaves; pods 3-angled, bladdery.

Found on rich hillsides, etc. Common.

STYLOPHORUM DIPHYLLUM (wild celandine poppy). April-May.

Perennial 10-18 inches high; leaves pale beneath, deeply pinnatifid; flowers deep yellow, juice yellow.

Found in damp rich woods. Rare.

TRIFOLIUM REFLEXUM (Buffalo clover). April-August.
Biennial 6-10 inches high; stems ascending; downy leaflets finely toothed; flowers rose-red.
Found on rocky banks along streams. Rare.

TRILLIUM ERECTUM (ill-scented wake-robin). April-June.
Perennial 1-1½ feet high; leaves broad; flowers erect on pedunc les, 1-3 inches long, white.
Found on rich banks, etc. Rare.

TRILLIUM SESSILE (wake-robin). April-May.
Perennial, 8-12 inches high; leaves mottled; flowers sessile, purplish.
Found in woods and on banks. Common.

VACCINIUM VACILLANS (blue huckleberry). April-May.
Small shrubs; leaves small, smooth; branches yellowish-green; flowers greenish-yellow; berries blue.
Found on flinty hills, etc. Common.

VERBENA CANADENSIS (large-flowered verbena). April-August.
Perennial 8-12 inches high, spreading when older, soft-hairy; flowers reddish purple.
Found in glades and open woods. Common.

VIBURNUM PRUNIFOLIUM (stag bush, black haw). April-June.
Small trees; buds small, grayish; leaves finely and sharply serrate; flowers white; fruit black.
Found on dry or moist banks and in woods. Rare.

VIBURNUM RUFIDULUM (southern black haw). April-May.
Small trees; buds reddish, tomentose; leaves finely toothed; flowers white; fruit black.
Found in glades, on hills, etc. Our commonest black haw.

VIOLA CUCULLATA (meadow-blue violet). April-June.
Perennial; our common blue violet of yards, roadsides, fields, etc. Very common.

VIOLA PEDATA (bird-foot violet). April-June.
Perennial 4-6 inches high, smooth, stemless; flowers lilac-purple, 2 upper petals sometimes dark purple.
Found on flinty hills, etc. Rather common.

VIOLA PUBESCENS (hairy yellow violet). April-May.
Perennial; stems pubescent, leafy, 8-12 inches high; flowers yellow.
Found in dry rich woods. Rather scarce.

VIOLA STRIATA (striped white violet). April-May.
Perennial 4-8 inches high, smooth or nearly so; stems leafy; flowers white with yellow stripes.
Found in low shady places. Common.

ZANTHOXYLUM AMERICANUM (prickly ash). April-May.
Shrubs 6-10 feet high; stems very prickly; leaves pinnate; flowers in axillary clusters.
Found in rich soil, on banks, etc. Not common.

ZIZIA AUREA (golden meadow parsnip). April-June.
Perennial 1-2 feet high, smooth; lower leaves long-petioled; flowers yellow.
Found in glades, banks, etc. Common.

NOTES.

Mr. John Noyes landscape designer to the Garden, attended the Cleveland Flower Show, April 4.

Dr. Edgar Anderson, Head of the School for Gardening, spoke before the Parent-Teachers' Association of the Locust Grove School, April 14, on "Forestry."

Dr. J. M. Greenman, Curator of the Herbarium, presented a paper before the Phi Sigma of Washington University, April 1, on "Botanical Observations in Central America."

At their March meeting the trustees of Wellesley College conferred the degree of Master of Arts upon Dorothy Moore Anderson, who has been working in the Graduate Laboratory at the Garden during the past two years.

As part of the City Beautiful program of the Woman's Chamber of Commerce, Dr. George T. Moore, Director of the Garden, addressed the members at a luncheon at the Coronado Hotel, April 16, on "Lawns and Flowers."

Dr. J. M. Greenman, Curator of the Herbarium, has been elected president of the Washington University chapter of Sigma Xi for the coming year, and also an honorary member of the Washington University chapter of Phi Beta Kappa.

The annual flower sermon, provided for in Henry Shaw's will, will be preached at Christ Church Cathedral, Sunday, May 10, by the Rev. Harry P. Nichols, D. D., of New York City.

The landscape department of the University of Illinois visited the Garden, March 28; other recent visitors include Mr. Leonard Barron, editor "The Garden Magazine," March

27; Mr. Loring Underwood, landscape architect of Boston and instructor in landscape architecture at Harvard University and Lowthorpe School, March 21; and Mr. E. L. Newcome, of the University of Minnesota, April 24.

Dr. George T. Moore, Director of the Garden, spoke before the Cincinnati Chamber of Commerce, April 21, on "What Good is a Botanical Garden?" After his address there was a conference with manufacturers and other heads of industry to discuss the importance of botanical research as an aid to industry.

Dr. Moore spoke before the American Philosophical Society, Philadelphia, April 24, on "The Subterranean Algal Flora" and "Analysis of the Smoke Pollution of the Air of a Large City by Means of the Owen Automatic Filter."

Dr. Hans Molisch, professor of plant physiology, University of Vienna and member of the Academy of Science of Vienna, stopped over at St. Louis to visit the Garden, March 29, on his way to Vienna from the Imperial Tohoku University, Sendai, Japan, where he spent the last two years organizing the department of plant physiology.

STATISTICAL INFORMATION FOR MARCH, 1925

GARDEN ATTENDANCE:

Total number of visitors..... 13,272

PLANT ACCESSIONS:

Total number of plants received in exchange..... 131
Total number of seed packets received in exchange... 385

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 51
Total number of books and pamphlets donated..... 46

HERBARIUM ACCESSIONS:

By Gift—

Churchill, Hon. Joseph R., by Walter Deane—Plants of Virginia 31
Mathias, Mildred, Doris Bausch, and Robert Woodson—*Mnium* sp. from St. Louis County, Missouri..... 1
Schrenk, Dr. H. von—*Nyssa* sp. from Mississippi..... 1
Seaver, Dr. F. J.—*Stereum pusiolum* B. & C. from Porto Rico 2
Urban, Dr. I.—West Indian Senecios collected by E. L. Eckman 45
Young, Mrs. Henry S.—*Scutellaria ovata* Hill. and *Ptilimnium Nuttallii* (DC.) Britton from Arkansas..... 2

By Purchase—

Canton Christian College—Plants of China.....175
Fisher, George L.—Plants of Lapland..... 89
Stevens, Dr. F. L.—Fungi of Central America and British Guiana 156

By Field Work—

Allen, Cyril—Plants of Colombia, South America.....160

Total 662

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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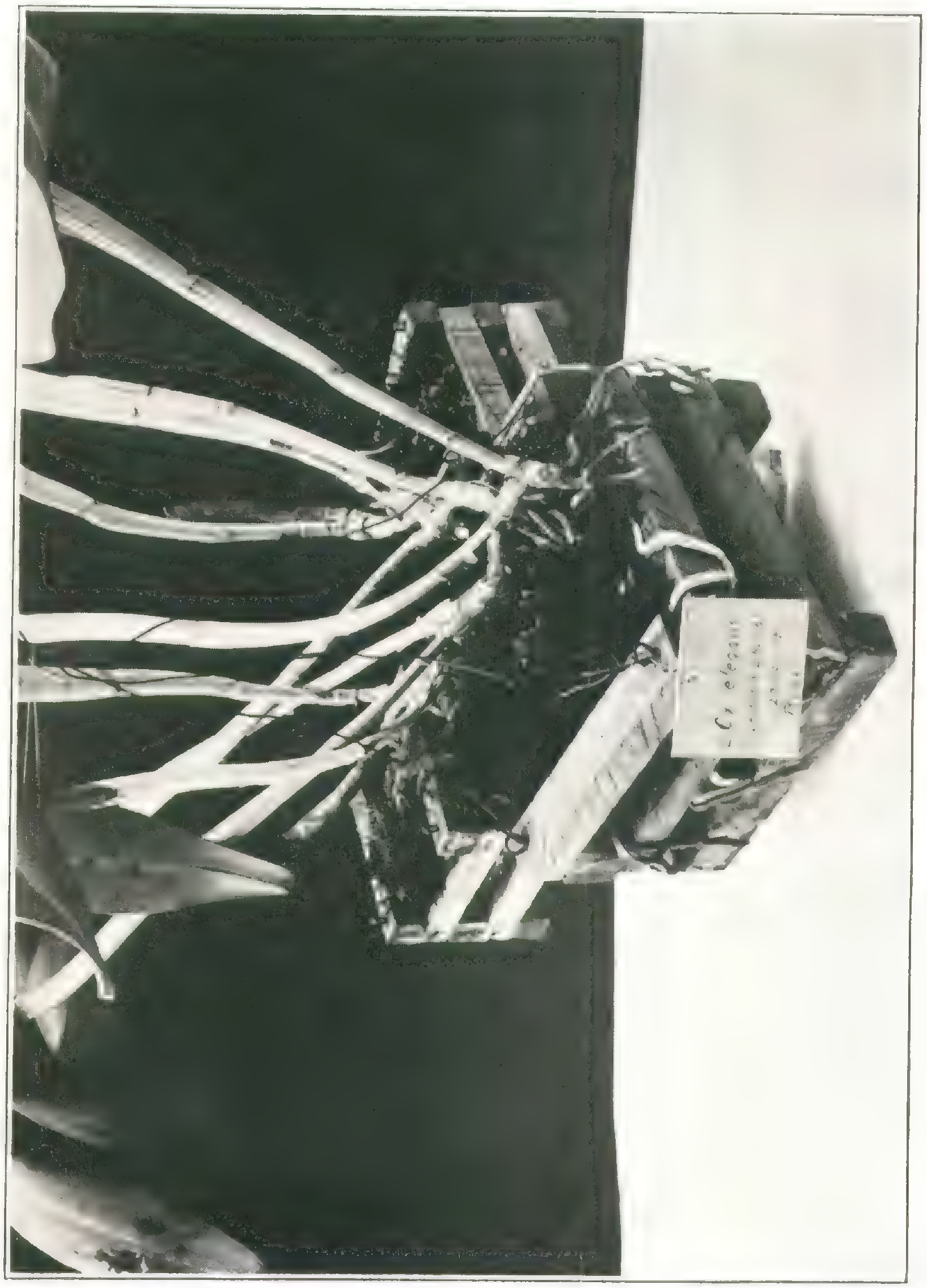

SHOWING TWO BASKETS ATTACHED.

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VEGETATIVE PROPAGATION OF ORCHIDS

The restriction placed upon importing orchids from the tropics by Quarantine 37 has forced the American orchid grower to attempt to perpetuate his collection either from seed or by division of the parent plant. Raising orchids from seed has never been very successful in St. Louis, although during the past ten years thousands of attempts have been made.

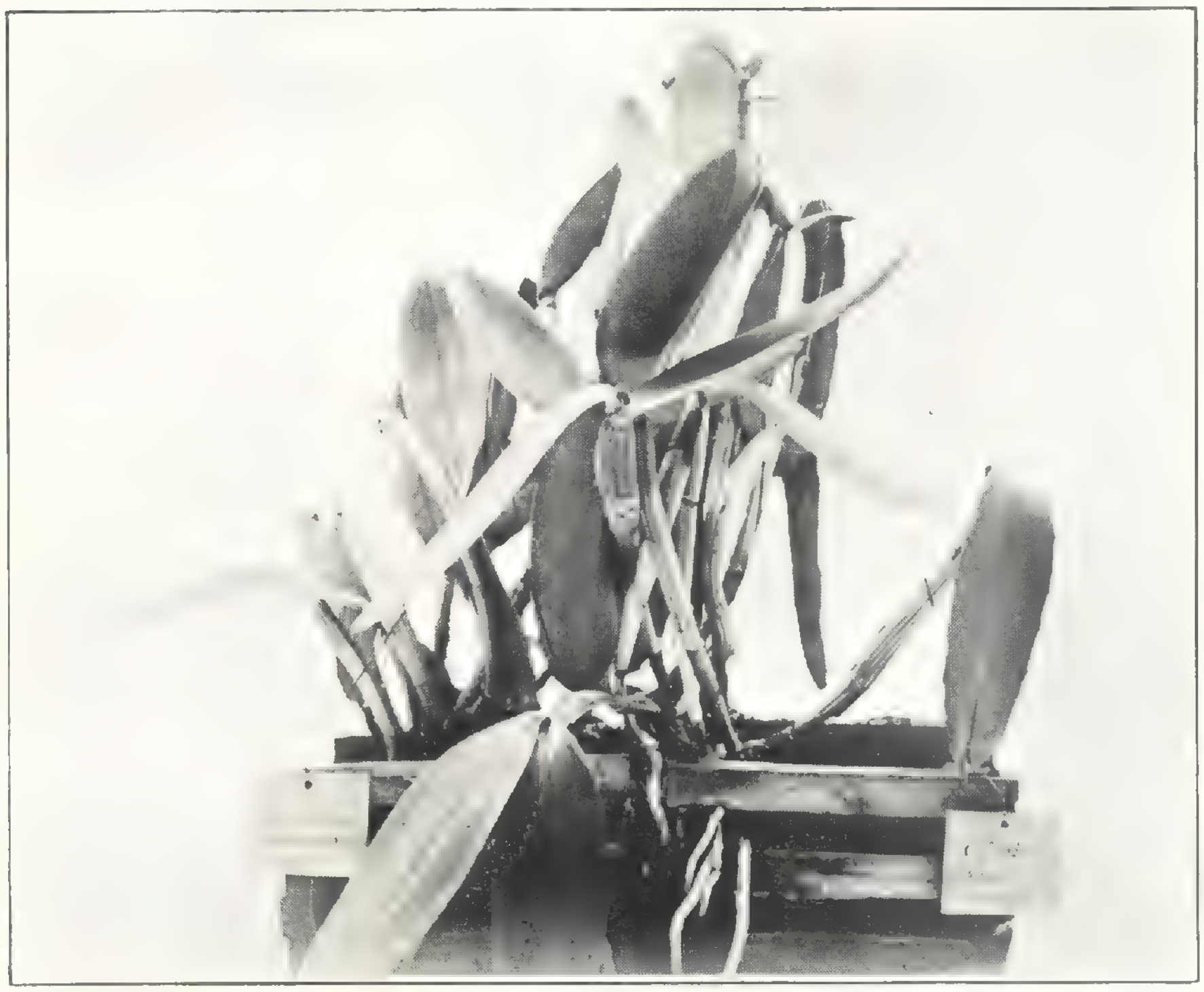
That the particular location is a decided factor in propagating orchids is well demonstrated by an examination of these plants in their natural environment. Cattleyas may be present in numbers upon trees on one side of a mountain range, whereas the opposite side will be devoid of the species, and the extremely limited area to which some of the species are confined is well known. When cattleyas are brought down from an elevation of 5000-7000 feet to the lower levels the life of the plant, even in the tropics, is seriously affected. Numerous examples of this fact may be noticed in the towns of Colombia. Here, *Cattleya Trianae*, removed from the high altitudes to the patios of houses at lower elevations, deteriorate rapidly although the plants grow naturally only a few miles away. The so-called dry seasons of the tropics are apt to lead one to suppose that orchid plants during this period are without moisture. On the contrary, at the altitude at which cattleyas grow there is always an even temperature and sufficient moisture is available during the night to prevent shriveling of the pseudo-bulbs. One always finds

a heavy precipitation in the form of dew during the early morning.

The hot summer months in St. Louis put orchids to a severe test at which both seedlings and vegetative propagations receive their greatest set-back. Consequently European or eastern United States methods of cultivation have to be considerably modified in the Middle West. For example, in the East practically all cattleyas and their hybrids are grown in pots, while in St. Louis this practice invariably results in great loss. Indeed, not only orchids but most epiphytes lose most of their roots when grown in pots during the summer. If grown in baskets, however, these plants may be watered several times a day during the hot season without becoming water-logged as they are apt to be in pots.

In this climate orchids suffer a decided shock even when transplanted, being set back from one to two years. The general practice for propagation of cutting away the superfluous back bulbs by forcing the dormant eyes usually results in the shriveling of the bulbs and ultimate death of the plant. In recent years a reversal of this method has proved a most satisfactory means of propagation. A plant is selected when the growing end is reaching out over the basket, and a small basket packed with peat and moss is attached immediately under the lead in such a manner as to receive the new roots. At the same time the rhizome is cut half way through behind the three or four pseudo-bulbs from the current year's growth. By so doing one of the back eyes is forced into growth, ultimately producing flowers. These back growths, not being disturbed, show no signs of shriveling as they almost certainly would if immediately segregated from the plant, as is the more general practice.

In using this method one must have sufficient patience to wait until both sections of the plant are well rooted before finally separating them. Another advantage of this system of propagation is that it does away with frequent rebasketing. Eastern orchid growers experience no difficulty when repotting cattleyas, some even suggesting the cutting away of all old roots as unnecessary material, but if this method were practiced at the Garden the collection would be ruined



BEFORE SEPARATING NEW PLANT.

AFTER SEPARATING, SHOWING BOTH PLANTS IN BUD.

in a few years. In this part of the country the less epiphytic orchids are disturbed the better the results, and by adopting the system of propagation indicated above one will have almost complete success. After segregation the parent plant should not be disturbed except for replenishing with new peat, being careful that all roots attached to the basket are not disturbed, since these hold the plant securely in position.

LIST OF MISSOURI WILD FLOWERS ACCORDING TO TIME OF BLOOMING

(Continued from April Bulletin)

MAY

AMORPHA FRUTICOSA (false indigo). May-July.
Shrubs 6-10 feet high; leaves odd-pinnate, leaflets 9-25; flowers in dense terminal spikes, violet or purple, stamens yellow.
Found along river banks, etc. Not common.

ANEMONE CANADENSIS (anemone). May-June.
Perennial 8-12 inches high, hairy, with running rootstocks; leaves 5–7-parted; flowers white, showy.
Found in prairies, on banks, etc. Rare.

APLECTRUM HYEMALE (Adam-and-Eve). May-June.
Perennial; leaf solitary, disappearing before the appearance of the flower spike; flowers greenish or yellowish tinged with purple.
Found in rich woods. Very rare.

ARISAEMA DRACONTIUM (green dragon). May-June.
Perennial 1-2 feet high; leaf usually solitary, divided into 7-11 pointed leaflets; spadix tapering to a long, slender point enclosing the spathe.
Found along moist, rich, woody banks, etc. Common.

ARISTOLOCHIA TOMENTOSA (Dutchman's pipe, pipe vine). May-June.
Climbing woody vine 15-30 feet high; leaves round-heart-shaped, soft-hairy; flowers shaped like a pipe, calyx yellowish with a purple center.
Found on river banks, etc. Not common.

ARUNCUS SYLVESTER (goat's beard). May-July.
Perennial 4-6 feet high; leaves 2–3-pinnate; stems erect, simple; flowers small, white, in a large pyramidal panicle.
Found in rich soil, shaded banks, etc. Common.

ASCLEPIAS QUADRIFOLIA (four-leaved milkweed). May-July.
Perennial 2-3 feet high; stem slender; upper leaves in fours; flowers in umbels, pinkish white.
Found in dry woods and on hills. Not common.

ASCLEPIODORA VIRIDIS (oblong-leaved milkweed). May-July.
Perennial 1-2 feet high, almost smooth; leaves alternate, short-stemmed, broad; umbels several in a cluster, flowers large, green with a purplish crown.
Found in prairies and glades. Not common.

ASTRAGALUS MEXICANUS (ground plum). May.
Perennial 6-12 inches high; leaves odd-pinnate, slightly pubescent; flowers cream-colored, bluish at the tip; pods like green plums.
Found in prairies and glades. Common.

BAPTISIA ALBA (white wild indigo). May-June.
Perennial 2-3 feet high, smooth; branches slender and wide-spreading; flowers white, racemes slender, on a long, naked peduncle.
Found in dry open woods. Not common.

CASTILLEJA SESSILIFLORA (painted cup). May-July.
Perennial 10-16 inches high, very leafy; leaves 3–5-cleft with narrow lobes; flowers yellowish red; root parasitic.
Found in prairies and open dry ground. Rare.

CEANOTHUS AMERICANUS (New Jersey tea, red root). May-July.
Low shrub 1-3 feet high; leaves 3-ribbed, serrate; flowers in small umbel-like clusters, white; root red.
Found on rocky hills. Common.

CLEMATIS PITCHERI (leather flower). May-August.
Climbing vine 4-8 feet high; leaves usually 3–9-foliate, entire or 3-lobed; flowers leathery, bell-shaped, purplish.
Found in rich soil, on banks, etc. Rather common.

CONVOLVULUS ARVENSIS (small bindweed). May-September.
Perennial; stem procumbent or low and twining; leaves arrow-shaped, lobes acute; flowers white tinged with red.
Found in old fields, waste places, etc.; naturalized from Europe. Not common.

COREOPSIS AURICULATA (lobed tickseed). May-August.
Perennial 1-2 feet high, pubescent, branching, sometimes with runners; leaves petioled, entire; flowers yellow.
Found in rich woods, etc. Not common.

COREOPSIS LANCEOLATA (lance-leaved tickseed). May-August.
Perennial 1-2 feet high, smooth, sometimes hairy, branched at the base; leaves mostly entire; flowers large, yellow.
Found in rich woods. Not common.

CORNUS ALTERNIFOLIA (alternate-leaved dogwood). May-July.
Shrub or small tree; branches greenish streaked with white; leaves alternate, clustered at the end of the branchlets; flowers white; fruit blue.
Found on rich hillsides. Rare here; only one locality.

CORNUS ASPERIFOLIA (rough-leaved dogwood). May-June.
Shrubs or small trees; branches brownish, rough-pubescent; leaves rough above, pale beneath; flowers small, white; fruit white.
Found on banks and hillsides. Common.

CROTON CAPITATUS (goat weed). May-October.
Annual 10-18 inches high, soft-woolly, branched; leaves long-petioled, entire; plant strong-scented.
Found in barrens, open places, etc. Common.

DATURA STRAMONIUM (thorn apple, Jimson weed). May-September.
Annual 2-4 feet high, smooth; stem green; leaves toothed or angled; flowers white; capsule prickly.
Found in waste places. Common.

DATURA TATULA (purple thorn apple, Jimson weed). May-September.
Annual, smooth; stem purple; leaves toothed or angled; flowers pale purple.
Found in waste places. Common.

DESMANTHUS ILLINOENSIS (wild mimosa). May-September.
Perennial 3-5 feet high, nearly smooth, erect; leaves twice-pinnate, with numerous small leaflets; flowers small, axillary; peduncles bearing a head of small greenish white flowers.
Found in prairies and open places. Not common.

DIANTHERA AMERICANA (water willow). May-August.
Perennial 1-2 feet high; stem leafy; leaves linear; flowers purplish, in axillary spikes.
Growing in water or wet places. Common along the Meramec River.

DICENTRA CANADENSIS (squirrel corn). May-June.
Perennial 4-8 inches high; subterranean shoots bearing scattered grain-like tubers; leaf ternately compound; flowers white, very short-spurred.
Found in rich woods and on banks. Rare here; only one locality.

DIOSPYROS VIRGINIANA (persimmon). May-June.
Trees; leaves thickish, smooth or nearly so; calyx 4-parted; corolla pale yellow, bell-shaped.
Found in old fields, woods, etc. Common.

ERIGERON ANNUUS (sweet scabious). May-November.
Annual 2-4 feet high; stem stout, branched, leafy; leaves coarsely toothed; flowers white tinged with purple.
Found in fields, waste places. Common.

ERIGERON RAMOSUS (daisy fleabane). May-November.
Annual 2-3 feet high; stem panicled at the summit, roughish; leaves entire or mostly so, scattered; flowers white.
Found in fields, etc. Common.

ERYSIMUM ASPERUM (western wall-flower). May-July.
Biennial 1-2 feet high, minutely rough-hoary; stem simple; leaves entire or some toothed; flowers bright orange-yellow, showy.
Found in limestone glades, etc. Not common.

GALIUM CIRCAEZANS (wild liquorice). May-July.
Perennial, 4-8 inches high, pubescent; leaves in fives; flowers greenish white; roots thread-like, yellow.
Found in rich woods, etc. Common.

GALIUM CONCINNUM (shining bedstraw). May-August.
Perennial 4-6 inches high; stems square, rough; leaves in whorls of sixes; flowers white.
Found on dry hillsides, etc. Common.

GNAPHALIUM PURPUREUM (purplish cudweed). May-September.
Perennial 1-2 feet high, silvery with dense white wool; leaves green above; heads in sessile clusters in the axils of the upper leaves and spiked at the summit of the stem, flowers purplish, strong-scented.
Found in sandy soil. Not common.

HEUCHERA HIRSUTICAULIS (hairy alum root). May.
Perennial 1-2 feet high; stems and petioles hairy with whitish hairs; leaves kidney-shaped with 7-11 shallow lobes; flowers greenish or purplish. The only Heuchera we have here.
Found on bluffs and rocky banks. Not common.

HOUSTONIA ANGUSTIFOLIA (narrow-leaved houstonia). May-July.
Perennial 8-12 inches high; stems branching from the base, woody-like; flowers whitish.
Found in barrens, glades, etc. Common.

HOUSTONIA PURPUREA (large houstonia). May-September.
Perennial 4-8 inches high, smooth, branching from the base; stems square; flowers bluish white.
Found on dry hills. Rather common.

HYBANTHUS CONCOLOR (green violet). May-June.
Perennial 1-2 feet high; stem leafy to the top; flowers small, greenish white, from 1-3 in the axils of the leaves.
Found on rich rocky banks, etc. Common.

HYDROPHYLLUM APPENDICULATUM (appended waterleaf). May-June.
Annual 1-2 feet high, hairy; leaves palmately 5-lobed; flowers pale blue.
Found in damp rich woods. Common.

HYDROPHYLLUM VIRGINIANUM (Virginia waterleaf). May-August.
Perennial 1 foot high, smoothish; leaves pinnately divided, 5–7-lobed; flowers pale blue.
Found in rich woods. Scarce.

HYPOXIS HIRSUTA (star grass). May-October.
Perennial 3-6 inches high; leaves grass-like, longer than the 1–4-flowered scape; root a bulb; flowers yellow.
Found in meadows and open woods. Scarce.

IPOMOEA PANDURATA (wild potato-vine). May-September.
Perennial, trailing or climbing vines; flowers large, white, with purple in the tube.
Found on dry limestone banks, etc. Common.

ISOPYRUM BITERNATUM (false rue anemone). May.
Perennial 4-8 inches high, slender, smooth; flowers white.
Found in moist shady woods. Scarce.

IRIS VERSICOLOR (larger blue flag). May-July.
Stems stout, angled on one side; flowers blue, striped with yellow and white. Our common blue flag.
Found in swamps, etc. Common.

LATHYRUS PALUSTRIS (marsh vetchling). May-August.
Perennial, slender, smooth, climbing or trailing vines with winged stems; flowers purple.
Found along banks of streams, etc. Scarce.

LITHOSPERMUM ARVENSE (corn gromwell). May-August.
Annual 6-10 inches high, roughish-hoary, much branched; flowers small, white.
Found in old fields, open places, etc. Common.

MONARDA BRADBURIANA (Bradbury's monarda). May-July.
Perennial 1-2 feet high; stems square; leaves soft-hairy; flower heads solitary, flowers pale purplish, dotted in the throat.
Found in dry open woods, etc. Common.

NEPETA HEDERACEA (ground ivy). May-July.
Perennial 2-4 inches high, creeping or trailing; leaves round-kidney-shaped, green on both sides; flowers blue.
Found in damp shady places. Rather common.

OENOTHERA LINIFOLIA (thread-leaved sundrop). May-July.
Annual 6-18 inches high, slender, erect, smooth; flowers small, yellow.
Found in sand hills, etc. Not common.

OENOTHERA MISSOURIENSIS (Missouri primrose). May-July.
Perennial 1-1½ feet high, decumbent, canescent; leaves thickish; flowers large, yellow; pods large, 4-angled.
Found in limestone glades. Scarce.

OENOTHERA SPECIOSA (showy primrose). May-July.
Perennial 1-2 feet high, erect; flowers large, white.
Found in open woods. Rare.

ONOSMODIUM HISPIDISSIMUM (false gromwell). May-July.
Perennial 2-3 feet high, rough hispid; flowers in raceme-like clusters, greenish yellow.
Found in glades, on banks, etc. Rather common.

OSMORHIZA CLAYTONI (hairy sweet cicely). May-June.
Perennial 2-3 feet high, rather slender, very pubescent; roots thick, aromatic; flowers white.
Found in rich woods. Common.

OSMORHIZA LONGISTYLIS (smooth sweet cicely). May-June.
Perennial 2-3 feet high, nearly smooth; roots aromatic; flowers white.
Found in rich woods. Not common.

OXALIS VIOLACEA (violet wood sorrel.) May-June.
Perennial 3-6 inches high; root a scaly bulb; leaves 3-foliate; scape umbellate, several-flowered; flowers violet.
Found in rocky places, etc. Rather common.

PARTHENIUM INTEGRIFOLIUM (American feverfew). May-September.
Perennial 2-4 feet high, rough; rootstocks thickened but not creeping; flowers white, in a flat corymb.
Found in dry soil, etc. Common.

PARTHENIUM REPENS (creeping parthenium). June.
Perennial 1-2 feet high, spreading by slender running roots; stem hispid; leaves hispid on both sides; flowers white, in loose-flowered corymbs.
Found in limestone glades, etc. Not very common.

PASSIFLORA LUTEA (yellow passion-flower).
Perennial climbing vine, smooth, slender; leaves 3-lobed; flowers greenish yellow, small.
Found in damp thickets. Rather common.

PENTSTEMON HIRSUTUS (hairy beard-tongue). May-July.
Perennial 1-2 feet high, hairy; flowers purplish white.
Found in dry or rocky ground. Common.

PENTSTEMON LAEVIGATUS (smooth beard-tongue). May-July.
Perennial 2-3 feet high, mostly smooth; leaves firm, glossy; flowers white tinged with purple.
Found in drier situations. Common.

PENTSTEMON LAEVIGATUS VAR. DIGITALIS (foxglove beard-tongue). May-July.
Perennial 2-4 feet high, smooth; leaves glossy; flowers white tinged with purple, large.
Found in wet places. Rather common.

PHLOX GLABERRIMA (smooth phlox). May-July.
Perennial 2-3 feet high, smooth; leaves narrow, long, rough-margined; flowers pink or whitish.
Found in prairies, open woods. Rare.

PLANTAGO ARISTATA (large-bracted plantain). May-October.
Annual 4-10 inches high, hairy; leaves narrow.
Found in poor soil, old fields, etc. Common.

PODOPHYLLUM PELTATUM (May-apple). May.
Perennial 1-2 feet high, smooth; roots creeping; leaves large, peltate; flowering stems forked, with 2 leaves; flowers large, fragrant, white; fruit large.
Found in rich woods. Common.

POLYGONATUM COMMUTATUM (Solomon's seal). May-July.
Perennial 2-4 feet high, smooth; leaves partly clasping; flowers 2-8, in clusters on the under side of stem, in the axils of the leaves.
Found in woods, along banks, etc. Common.

PRUNUS SEROTINA (wild cherry). May.
Trees; branches reddish brown; leaves shining above; flowers white, in elongated racemes; fruit purplish black.
Found in woods. Common.

PSORALEA TENUIFLORA (few-flowered psoralea). May-October.
Perennial 2-4 feet high, erect, much-branched; flowers in loose racemes, purplish.
Found in glades, etc. Common.

RHAMNUS CAROLINIANA (Carolina buckthorn). May-June.
Shrubs or small trees, thornless; leaves smooth, shining; flowers axillary; fruit black, ripening in the fall.
Found along river banks, on rocky hills, etc. Rather common.

RHAMNUS LANCEOLATA (lance-leaved buckthorn). May.
Shrubs, thornless; leaves narrow, long; flowers yellowish green, very numerous; fruit small, ripening early.
Found on hills, in glades, etc. Not common.

RIBES GRACILE (wild gooseberry). May.
Shrubs; spines long, stout, red; flowers white, in clusters on long stems.
Found in thickets, old fields, etc. Common.

ROSA HUMILIS (low or pasture rose). May-July.
Low, 1-2 feet high, slender, with straight prickles; leafllets mostly 7, dark green, thin; flowers often solitary.
Found in dry rocky soil. Common.

RUBUS OCCIDENTALIS (black raspberry). May-June.
Shrubs; stems recurved, rooting at the tips; plant glaucous all over; leaflets 3, rarely 5, white-downy beneath; fruit black.
Found in rich soil, woods, etc. Common.

RUDBECKIA HIRTA (black-eyed Susan). May-September.
Annual 1-3 feet high, very rough throughout; flower heads large, single, showy, rays yellow.
Found in dry soil, etc. Very common.

RUELLIA STREPENS (smooth ruellia). May-July.
Perennial 1-2 feet high, smooth, branched; flowers large, blue.
Found in rich soil. Common.

SALVIA LYRATA (lyre-leaved sage). May-June.
Perennial or biennial, 1-3 feet high; stem simple or very little branched, hairy; leaves tufted at the base, a few pairs of small leaves along the stem; flowers violet, in whorls along the stems.
Found in dry limestone or sandy glades. Scarce locally.

SAMBUCUS CANADENSIS (elder). May-July.
Shrubs 4-10 feet high, pith white; leaflets 5-11, smooth; flowers white, in flat cymes; fruit black-purple.
Found in rich soil in open places. Very common.

SANICULA MARILANDICA (black snake root). May-July.
Perennial 1-2 feet high; stems erect; leaves 5–7-parted, sharply serrate; flowers small, greenish, in umbels.
Found in rich woods, etc. Common.

SAXIFRAGA FORBESII (Forbes' saxifrage). May.
Perennial 1-3 feet high, hairy, stout, branched; flowers in an open panicle, white, small.
Found on shaded limestone cliffs. Rare.

SCHRANKIA UNCINATA (sensitive brier). May-July.
Perennial 2-3 feet high, decumbent, very prickly; leaves twice-pinnate; flowers in round heads, small, rose-colored; pod very prickly.
Found along dry banks, in open woods, etc. Rare.

SOLANUM CAROLINENSE (horse nettle). May-September.
Perennial 1-2 feet high, prickles stout, yellowish; flowers violet or whitish; fruit smooth.
Found in waste places, fields, etc. Very common.

SISYRINCHIUM ANGUSTIFOLIUM (blue-eyed grass). May-August.
Perennial 6-10 inches high, erect, glaucous; stems winged, not much broader than the leaves; flowers violet.
Found in woods, fields, etc. Common.

SMILACINA RACEMOSA (false Solomon's seal). May-July.
Perennial 1-2 feet high, soft-downy; leaves numerous; flowers in a terminal raceme, white.
Found on banks, etc. Common.

SPECULARIA PERFOLIATA (Venus' looking-glass). May-September.
Annual 6-15 inches high, leafy-stemmed; leaves roundish, clasping; flowers axillary, mostly solitary, blue.
Found in sterile open ground, fields, etc. Rather common.

TAENIDIA INTEGERRIMA (yellow pimpernel). May-June.
Perennial 1-2 feet high, smooth, glaucous, slender, aromatic; leaves 2–3-ternate; flowers yellow.
Found in dry gravelly woods, glades, etc. Common.

TALINUM TERETIFOLIUM (fame flower). May-August.
Perennial 4-8 inches high, from a rosette of fleshy leaves; flowers rose-colored.
Found on sandstone ledges, etc. Rare.

THASPIUM AUREUM (yellow meadow parsnip). May-June.
Perennial 1-2 feet high, smooth; root-leaves cordate, serrate; flowers yellow.
Found in thickets and woods. Common.

TILIA AMERICANA (American linden, basswood). May-June.
Large trees, wood soft, white; leaves large, green, smooth; flowers in small pendulous axillary peduncles, cream-colored, fragrant.
Found in rich woods. Common.

TRADESCANTIA VIRGINIANA (spiderwort). May-August.
Perennial 2-3 feet high, green; leaves lance-linear, upper more or less hairy; flowers purplish blue, variable.
Found along banks, in woods, etc. Very common.

TRIFOLIUM STOLONIFERUM (running Buffalo clover). May-October.
Perennial; stems with long runners from the base, smooth; leaves finely serrate; flowers white, in loose heads.
Found along gravelly creeks. Rare.

TRIOSTEUM ANGUSTIFOLIUM (narrow-leaved horse gentian). May-August.
Perennial 1-2 feet high, very hairy; leaves tapering to the base, reddish when young; flowers greenish cream-colored, in the axils of the leaves; fruit orange-colored.
Found in shady ground. Not common.

TRIOSTEUM PERFOLIATUM (horse gentian). May-July.
Perennial 1-3 feet high, glandular-pubescent; leaves perfoliate, green, thickish; flowers purplish or yellowish; fruit 6-8 in a whorl at base of leaf, orange-yellow.
Found in rich woods. Common.

UVULARIA PERFOLIATA (perfoliate bellwort). May-June.
Perennial 1-1½ feet high; stems forking above; leaves perfoliate, glaucous, smooth; flowers yellow.
Found in rich woods. Common.

VIBURNUM LENTAGO (nannyberry). Black haw.
Small trees 10-20 feet high; leaves finely serrate, petiole winged; flowers white, in broad cymes; fruit blue-black, sweet, edible; winter buds long, grayish.
Found in woods, along banks of streams. Not common.

VINCETOXICUM CAROLINENSE (Carolina vincetoxicum). May-July.
Perennial climbing vine; leaves opposite, large, heart-shaped; flowers dark purple, in umbels, ill-smelling.
Found in limestone glades, etc. Not common.

VIOLA RAFINESQUII (wild pansy). May.
Annual 2-6 inches high, slender, branching, leafy-stemmed; flowers bluish white, striped.
Found in woods and open places. Common.

JUNE

ACALYPHA VIRGINICA (three-seeded mercury). June-October.
Annual 1-2 feet high, leafy, leaves often turning purple; flowers small, 1-3 in each axil of leaf.
Found in fields, open places, etc. Common.

ACERATES LANUGINOSA (woolly milkweed). June-August.
Perennial 1-2 feet high, hairy; leaves opposite, slender; flowers greenish, umbels solitary and terminal.
Found in prairies, open glades, etc. Not common.

ACHILLEA MILLEFOLIUM (yarrow). June.
Perennial 1-2 feet high; roots horizontal; leaves finely dissected into narrow pinnatifid segments; flowers white, rarely pink, terminal in dense compound corymbs.
Found in waste places, roadsides, etc. Common.

AMORPHA CANESCENS (lead plant). June-July.
Small shrubs 1-3 feet high, hoary-downy; leaves odd-pinnate; flowers violet, in spikes clustered at the top.
Found on dry flinty hills. Not common.

ANTHEMIS COTULA (May-weed or dog fennel). June-November.
Annual 1-2 feet high, smooth, branching; leaves finely dissected, strong-scented; ray-flowers white, disk yellow.
Found in waste places. Becoming rare.

APOCYNUM ANDROSAEMIFOLIUM (spreading dogbane). June-August.
Perennial 2-3 feet high, smooth, branches spreading; leaves mucronate-tipped, green above, pale beneath; cymes flowering simultaneously, flowers fragrant, pink.
Found in dry thickets, open woods. Scarce.

APOCYNUM CANNABINUM (dogbane). June-August.
Perennial 3-4 feet high, smooth; stems branching, juice milky; leaves opposite, pale green; flowers greenish white, central cyme flowering first; pods long, slender.
Found in old fields, open woods, etc. Common.

ARABIS CANADENSIS (sickle-pod). June-August.
Biennial 1-3 feet high; stems leafy; stem-leaves pubescent, pointed at both ends; flowers whitish; pods flat, seed broadly winged.
Found in rocky woods, glades, etc. Common.

ARENARIA PATULA (rock sandwort). June-July.
Annual 4-8 inches high, much branched, smooth; leaves subulate, small; flowers white.
Found on dry sand hills. Rare.

ASCLEPIAS PURPURASCENS (purple milkweed). June-August.
Perennial 2-4 feet high; stems slender; leaves thinner, taper-pointed, opposite; flowers dark purple.
Found in dry ground. Not common.

ASCLEPIAS SYRIACA (common milkweed). June-August.
Perennial 3-5 feet high; stems stout, soft-pubescent; leaves broad, thick, opposite; flowers dull purple, umbels lateral and terminal.
Found in rich ground, on banks, etc. Common.

ASCLEPIAS TUBEROSA (butterfly weed). June-September.
Perennial 1-3 feet high, rough-hairy, very leafy, branching at the top; juice not milky; flowers orange-colored.
Found in dry fields, on banks, etc. Rather common.

BLEPHILIA CILIATA. June-July.
Perennial 1-2 feet high, hairy, branched from base; leaves whitish-downy beneath; flowers bluish purple, in whorls.
Found in dry open places. Common.

BLEPHILIA HIRSUTA (hairy blephilia). June.
Perennial 1-3 feet high; stem very hairy, usually branched; leaves sharply toothed; flower clusters axillary or in short terminal spikes, upper lip much longer than the lower, pale purple with darker spots.
Found in rich woods, thickets, etc. Rather common.

BRAUNERIA ANGUSTIFOLIA (purple cone-flower). June-July.
Perennial 2-3 feet high, rough, not leafy; leaves long, narrow, 3-nerved, entire; flowers large, purplish.
Found in limestone glades, etc. Common.

BUMELIA LANUGINOSA (woolly buckthorn). June-July.
Small trees 15-25 feet high, end of branchlets often spiny; leaves rusty, woolly beneath; flowers small, white, in clusters; fruit black.
Found in rocky woods, glades, etc. Common.

CACALIA TUBEROSA (tuberous Indian plantain). June-August.
Perennial 3-5 feet high; stem angled and grooved; roots thick, tuberous; leaves green on both sides, smooth, strongly 5–7-nerved; flowers white.
Found in prairies, glades, etc. Not common.

CELASTRUS SCANDENS (climbing bittersweet). June.
Climbing woody vine; leaves alternate, finely serrate; flowers small, greenish white, in raceme clusters at the ends of the branches; fruit berry-like, orange-colored.
Found in thickets, etc. Common.

CEPHALANTHUS OCCIDENTALIS (button-bush). June-September.
Shrubs 6-10 feet high; leaves smooth, opposite, or sometimes in whorls of 3; flowers white, in round ball-like heads.
Found in swamps, on lake shores, etc. Common.

CLEMATIS FREMONTII (Fremont's clematis). June-July.
Perennial 1-2 feet high, erect, sparingly tomentose; leaves crowded, thick, often coarsely toothed; flowers bluish white, solitary, terminal.
Found in glades, etc. Rare.

COMANDRA UMBELLATA (bastard toad-flax). June-August.
Perennial 6-10 inches high; rootstock under ground, said to be parasitic; flowering stems very leafy; flowers white.
Found in glades, etc. Rather common.

COMMELINA VIRGINICA (Virginia day flower). June-September.
Perennial 1-2 feet high, slender, green; leaves lanceolate to linear; flowers pale blue.
Found in damp rich woods. Common.

CONVOLVULUS SEPIUM (great bindweed.) June-August.
Perennial, climbing or trailing vines; leaves halberd-shaped; flowers large, white, or pinkish.
Found in moist soil, cultivated ground, etc. Common.

COREOPSIS PALMATA (stiff tickseed). June-July.
Perennial 1-2 feet high, nearly smooth; leaves wedge-shaped, stiff, 3-lobed; flowers yellow.
Found in prairies. Rather common.

COREOPSIS PUBESCENS (star tickseed). June-August.
Perennial 1-1½ feet high, pubescent; leaves thickish, entire or with 2-4 lobes; flowers yellow, showy.
Found in woods, etc. Not common.

CROTALARIA SAGITTALIS (rattle-box). June-September.
Annual 6-10 inches high, hairy; leaves oval or oblong; flowers yellow; pods blackish, many-seeded.
Found in sandy soil, etc. Rare.

DIOSCOREA VILLOSA (wild yam-root). June-July.
Climbing herbaceous perennial vines; leaves mostly alternate, heart-shaped, downy beneath; flowers greenish yellow, in drooping panicles; pods 3-winged.
Found in rich thickets. Common.

DODECATHEON MEADIA (shooting star). May-June.
Perennial 1-2 feet high, smooth; leaves clustered at the base; scape naked with an umbel of rose-colored flowers at the top.
Found in open woods, etc. Not common.

ERIGERON CANADENSIS (horse-weed). June-November.
Annual 4-6 feet high, hairy; stem erect, much branched at the top; leaves linear; heads numerous, small.
Found in old fields, etc. Common.

ERIGERON PHILADELPHICUS (fleabane). June.
Perennial by stolons and offshoots; stem soft-pubescent or sometimes nearly smooth, 1-3 feet high; upper leaves clasping; flowers whitish, several or numerous, on slender stems.
Found in waste places, fields, etc. Common.

EVONYMUS ATROPURPUREUS (waahoo). June.
Shrubs; branchlets 4-sided; leaves opposite; flowers dark purple; pods smooth, deeply lobed.
Found on banks, hillsides, etc. Common.

GEUM CANADENSE (white avens). June-August.
Perennial 1-1½ feet high, slightly hairy; leaves pinnate, mostly 3–5-lobed; flowers white.
Found in borders of woods, etc. Common.

GILLENIA STIPULATA (American ipecac). June-July.
Perennial 1-3 feet high; leaves deeply incised, stipules large; flowers white.
Found in rich moist woods. Common.

HELENIUM NUDIFLORUM (purple-head sneezeweed). June-October.
Perennial 2-3 feet high, branching; stem angled; leaves alternate; flower heads yellow, disk brownish purple.
Found in sterile soil, etc. Not common here.

HELIOPSIS HELIANTHOIDES (ox-eye). June.
Perennial 3-5 feet high, smooth, branched above; leaves opposite, rarely in threes, rather thin, sharply dentate, mostly smooth on both sides; flowers long-stemmed, somewhat corymbose, 1½-2 inches wide, yellow.
Found in open places in woods. Not common.

HELIOPSIS SCABRA (rough ox-eye). June-September.
Perennial 3-5 feet high, roughish; leaves opposite, rough; flowers yellow, showy, terminal.
Found in glades, open woods, etc. Not common.

HERACLEUM LANATUM (cow parsnip). June-July.
Perennial; stem tall, stout, woolly, grooved; leaves large, compound; flowers white, in large umbels.
Found in rich shady woods. Only at Creve Coeur Lake in this vicinity.

HYDRANGEA ARBORESCENS (wild hydrangea). June-July.
Small shrubs 2-3 feet high, smooth; leaves opposite, pale green beneath; flowers white, the marginal ones often sterile.
Found on rocky banks, etc. Common.

HYDROPHYLLUM CANADENSE (broad-leaved waterleaf). June-August.
Perennial 8-15 inches high, nearly smooth; leaves broad, palmately 5–7-lobed, rounded, heart-shaped at base; flowers nearly white; root a scaly rhizome.
Found on rich moist banks and in woods. Not common.

LAPPULA VIRGINIANA (Virginia tickseed). June-September.
Biennial 2-3 feet high, rough-hairy; upper leaves pointed at both ends; flowers loosely panicled, white.
Found in woods, thickets, etc. Common.

LILIUM CANADENSE (wild yellow lily). June-July.
Perennial 2-4 feet high; leaves remotely whorled, 3-nerved, margins rough; flowers long-peduncled, yellow, nodding.
Found in moist open woods, along railroad banks, etc. Rare.

LINUM VIRGINIANUM (wild yellow flax). June-August.
Annual 1-2 feet high, smooth, branched; leaves thin, deep green; flowers scattered, yellow.
Found in dry woods, barrens, etc. Not common.

LEPACHYS PINNATA (gray-headed cone-flower). June-September.
Perennial 3-5 feet high, hoary with minute hairs, branching; leaves 3–7-parted; flowers yellow, rays long, drooping.
Found in dry glades, rocky woods, etc. Common.

LIPPIA LANCEOLATA (fog fruit). June-August.
Perennial, procumbent, or creeping; leaves green, slender, serrate above; flowers in solitary heads, bluish white.
Found along river banks, in moist places, etc. Common.

LYCOPUS AMERICANUS (cut-leaved water horehound). June-October.
Perennial 1-2 feet high; leaves sharply serrate; flowers white, in whorls.
Found in marshy places. Rather common.

LYSIMACHIA QUADRIFOLIA (whorled loosestrife). June-August.
Perennial 1-3 feet high, loosely hairy or smooth; leaves in whorls of from threes to sixes; flowers on long peduncles, from the axils of the leaves, yellow.
Found in moist or sandy soil. Not common.

MARRUBIUM VULGARE (white horehound). June-August.
Perennial 8-15 inches high, whitish-woolly; leaves opposite; flowers white, in axillary whorls.
Found in waste places. Not common.

MELILOTUS ALBA (white sweet clover). June-November.
Biennial 3-6 feet high, smooth, branching; leaves 3-foliate; flowers white, in spike-like racemes.
Found in waste places, roadsides, etc. Common.

MELILOTUS OFFICINALIS (yellow sweet clover). June-July.
Biennial 2-4 feet high, branching, smooth; leaves 3-foliate, finely serrate; flowers yellow, in racemes.
Found in waste places. Not common.

MIMULUS ALATUS (sharp-winged monkey-flower). June-September.
Perennial 2-3 feet high; stem winged; leaves tapering into a petiole, not clasping; flowers violet-purple.
Found in wet places, etc. Rather common.

MIMULUS RINGENS (square-stemmed monkey-flower). June-September.
Perennial 2-3 feet high, smooth; stem square; leaves clasping by a heart-shaped base, serrate; flowers violet-purple.
Found in wet places. Rather common.

MONARDA FISTULOSA (wild bergamot). June-September.
Perennial 3-5 feet high; stems square, more or less villous; flowers lilac-pink.
Found in dry soil, open places. Common.

MONOTROPA UNIFLORA (Indian pipe). June-August.
Perennial 4-6 inches high, white or pinkish, smooth, parasitic on roots of other plants; leaves scale-like or bracts; flowers solitary.
Found in rich woods. Rare.

PHYSOCARPUS OPULIFOLIUS (nine-bark). June.
Shrubs 6-8 feet high; old bark separating into thin layers, hence the name nine-bark; leaves somewhat 3-lobed; flowers white, in umbels.
Found on rocky banks, etc. Not common.

PHYSOSTEGIA VIRGINIANA (false dragon-head). June-September.
Perennial 2-3 feet high, smooth; leaves thickish, sharply serrate; flowers rose-colored, in terminal spikes.
Found in wet ground, etc. Rather common.

POLANISIA GRAVEOLENS (clammy weed). June-September.
Annual 1-2 feet high, clammy-pubescent; leaves with 3 oblong leaflets; flowers white, in leafy racemes.
Found along rivers and creeks, in gravelly places. Not common.

POLYGALA SANGUINEA (purple milkwort). June-September.
Annual 4-8 inches high, sparingly branched, leafy to the top; flowers red-purple, in globular heads.
Found in sandy and moist open woods. Rare.

POLYGONUM HYDROPIPEROIDES (mild water pepper). July-September.

Perennial 1-3 feet high, smooth, branching; sheaths hairy; leaves narrow; flowers white, spikes erect.

Found in wet places. Common.

POLYMNIA CANADENSIS (small-flowered leafcup). June-September.

Perennial 2-4 feet high, clammy-hairy; lower leaves pinnatifid, upper 3–5-lobed; flowers yellowish white.

Found on moist shaded banks. Common.

PONTEDERIA CORDATA (pickerel-weed). June-October.

Perennial 1-2 feet high, smooth; leaves heart-shaped, blunt; flowers blue, with 2 yellow spots; flowering stem with 1 leaf below the spike of flowers.

Found in ponds, lakes, etc. Rare here.

PRUNELLA VULGARIS (heal-all). June-September.

Perennial 8-15 inches high, mostly smooth; leaves opposite, entire or toothed; flowers violet or pink, in the axils of the leaves.

Found in woods and fields. Common.

PSORALEA ESCULENTA (pomme de prairie). June-July.

Perennial 1 foot high, roughish-hairy; leaves palmately 5-foliate; flowers purplish, in spike-like racemes; root turnip-shaped.

Found in glades, etc. Rare here.

PSORALEA ONOBRYCHIS (sainfoin psoralea). June-July.

Perennial 3-5 feet high, nearly smooth; leaves 3-foliate, taper-pointed; flowers white, in short racemes; seed-pods wrinkled.

Found along river banks, glades, etc. Not common.

PTELEA TRIFOLIATA (three-leaved hop tree, wafer ash). June.

Shrubs 6-10 feet high; leaves 3-foliate, soft-downy when young; flowers greenish white, in terminal cymes; seed winged like the elm.

Found in rocky places. Not common.

RHUS GLABRA (smooth sumac). June-August.

Shrubs 8-15 feet high, smooth, glaucous; leaflets 11-30, pale beneath; flowers greenish white or yellowish.

Found in dry soil, on hills, etc. Very common.

ROSA SETIGERA (climbing wild rose). June-July.

Climbing shrub 6-10 feet high, prickles stout; leaves 3–5-foliate, sharply serrate; flowers deep rose changing to white.

Found in borders of open woods, etc. Rather common.

RUELLIA CILIOSA (hairy ruellia). June-September.

Perennial 8-15 inches high, hirsute; leaves nearly sessile; flowers showy, blue.

Found in dry ground, glades, etc. Common.

SAURURUS CERNUUS (lizard's tail). June.
Perennial 2-4 feet high, pubescent when young, becoming smooth when older; leaves alternate, cordate at base, entire; flower spikes few, white, fragrant.
Found in swamps, muddy shores, etc. Not very common.

SCUTELLARIA CANESCENS (downy skullcap). June-August.
Perennial 1-2 feet high; stem branched, canescent; leaves somewhat cordate at base; flowers in terminal racemes.
Found in woods, along river banks, etc. Not common.

SCUTELLARIA VERSICOLOR (heart-leaved skullcap). June-August.
Perennial 1-2 feet high, soft-hairy; leaves cordate at base; flowers blue and white.
Found on shaded banks, etc. Not common.

SILENE STELLATA (starry campion). June-August.
Perennial 2-4 feet high; leaves in whorls of fours; flowers white.
Found on wooded banks. Rather common.

STACHYS PALUSTRIS (woundwort). June-September.
Perennial 1-3 feet high, leafy; stems square, hirsute on the angles; flowers in leafy spikes.
Found in wet ground. Common.

STEIRONEMA CILIATUM (fringed goosestrife). June-August.
Perennial 1-2 feet high, erect; leaves on long ciliate fringed petioles; flowers yellow, axillary.
Found in low ground, etc. Common.

STYLOSANTHES BIFLORA (pencil flower). June-September.
Perennial 4-8 inches high, erect or spreading, pubescent; leaves 3-foliate, narrow; flowers yellow.
Found in dry soil, etc. Not common.

TEPHROSIA VIRGINIANA (goat's rue or hoary pea). June-July.
Perennial 1-1½ feet high, silky-hairy, erect, leafy; leaves pinnate, leaflets 17-29, linear; flowers large, yellowish white marked with purple.
Found in dry rocky soil. Common.

TEUCRIUM CANADENSE (American germander). June-September.
Perennial 1-3 feet high, leafy; leaves short-petioled, serrate; flowers pink or purplish.
Found in rich low ground. Common.

THALICTRUM POLYGAMUM (tall meadow rue). June-September.
Perennial 3-5 feet high, smooth or nearly so; leaves 2-3 ternately compound; flowers white.
Found in rich soil, etc. Common

VERATRUM WOODII (false hellebore). June-July.
Perennial 1-3 feet high; stem sparingly leafy; leaves strongly veined; flowers in a narrow panicle, greenish purple.
Found on rocky hillsides, etc. Very rare.

VERBASCUM THAPSUS (great mullein). June-September.
Biennial 4-6 feet high, densely woolly, with winged stems; leaves sessile; flowers yellow, in cylindrical spikes.
Found in old fields, waste places, etc. Common.

VERBENA HASTATA (blue vervain). June-September.
Perennial 3-5 feet high; leaves taper-pointed, cut-serrate, petioled; flowers violet-blue.
Found in wet places. Not common.

VERBENA STRICTA (hoary vervain). June-September.
Perennial about 3 feet high, downy with soft whitish hairs; leaves sessile; flowers purple, rarely white.
Found in waste places, barrens, etc. Common.

VERONICA VIRGINICA (Culver's physic). June-September.
Perennial 3-5 feet high, smooth; leaves whorled in fours to sevens, short-petioled; flowers white, in terminal spikes.
Found in rich soil. Rather common.

NOTES

Dr. B. M. Duggar, Physiologist to the Garden, has been appointed chairman of the division of biology and agriculture of the National Research Council. He will spend the months of July and August at the summer office, at the Marine Biological Laboratory, Woods Hole, Massachusetts.

Dr. Hermann von Schrenk, Pathologist to the Garden, gave an address before the Canadian Institute of Engineers, at Montreal, April 30, on "Timber Preservation."

Dr. B. M. Duggar spoke before the scientific staff of the Ohio Agricultural Experiment Station, April 30, on "Some Principles in Research."

Dr. George T. Moore, Director of the Garden, spoke before the Sales Managers' Bureau of the Chamber of Commerce at a luncheon, May 1, on "Conservation of Forests and Natural Resources."

The delegates attending the twentieth annual meeting of the American Association of Museums were guests of the Director and Board of Trustees of the Missouri Botanical Garden at luncheon in the Garden, May 19. After the lunch-

eon they were conducted on a tour of inspection of the grounds.

Dr. B. M. Duggar, Physiologist to the Garden, attended the meetings of the organizing committee of the International Congress of Plant Sciences, Ithaca, New York, April 24; of the American Philosophical Society, Philadelphia, April 25; of the division of bacteriology and agriculture of the National Research Council, and of the executive committee of the American Association for the Advancement of Science, Washington, April 26.

Recent visitors to the Garden include Dr. H. Teuscher, of the Morton Arboretum, Lisle, Illinois; Prof. O. E. Jennings, professor of botany, University of Pittsburgh, and Dr. W. P. Wilson, director of the Commercial Museum, Philadelphia, who were attending the convention of the American Association of Museums; Mr. H. Fukushi, of Tokyo Agricultural College; and Prof. Edwin R. Spencer, professor of biology, Southeastern State Normal College, Cape Girardeau, Missouri.

STATISTICAL INFORMATION FOR APRIL, 1925

GARDEN ATTENDANCE:

Total number of visitors..... 17,418

PLANT ACCESSIONS:

Total number of plants received as gifts..... 214
Total number of seed packets received as gifts..... 172

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 176
Total number of books and pamphlets donated..... 315

HERBARIUM ACCESSIONS:

By Gift—

Archias, L. H.—Plants of Missouri..... 3
Epling, Dr. Carl—Photographs of type specimens of Labiatae 23
Jennison, Dr. H. M.—*Obolaria virginica* L. from Tennessee 1
Schulenburg, Mrs. A. W.—*Erythrina herbacea* L. from Alabama 1
von Schrenk, Dr. Hermann—*Picea Engelmannii* Engelm. and *Abies* sp. from New Mexico..... 6
von Schrenk, Dr. Hermann, *Nyssa* sp. from Mississippi.. 1

By Exchange—

Botanical Garden, Leningrad, Russia, by Professor Boris Fedtschenko—Plants of Central Asia, Turkestan, Brazil, etc. 336
Field Museum of Natural History—*Satureia* sp. from Peru 1

By Purchase—

Arnold Aboretum—Plants of the United States, collected by E. J. Palmer in 1924.....1026

Total 1398

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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Missouri Botanical Garden Bulletin

Vol. XIII JUNE, 1925 No. 6

LIST OF MISSOURI WILD FLOWERS ACCORDING TO TIME OF BLOOMING.

(Continued from May Bulletin)

JULY

ACERATES VIRIDIFLORA (green milkweed). July-September.
Perennial 1-3 feet high, soft-downy; leaves thick, oval or oblong; flowers greenish, in dense umbels.
Found in dry soil, glades, etc. Not common.

AGASTACHE NEPETOIDES (giant hyssop). July-September.
Perennial 4-6 feet high; stem sharply 4-angled, smooth; leaves opposite, coarsely toothed; flowers in terminal spikes, greenish yellow.
Found in borders of woods, etc. Common.

AGRIMONIA PARVIFLORA (many-flowered agrimony). July-October.
Perennial 2-4 feet high; stem hairy, leafy; leaflets numerous, of different sizes; flowers white.
Found in moist soil, etc. Not common.

ALLIUM STELLATUM (prairie wild onion). July-August.
Perennial 10-16 inches high; stems round, slender; flowers in erect umbels, rose-colored, showy.
Found in rocky glades, etc. Common.

AMBROSIA ARTEMISIÆFOLIA (smaller ragweed). July-October.
Annual 2-3 feet high, hairy or roughish, much-branched; leaves thin, bipinnatifid, variable; flowers greenish white.
Found along roadsides, waste places, etc. Very common.

AMBROSIA BIDENTATA (lance-leaved ragweed). July-September.
Annual 1-3 feet high, hairy, very leafy; leaves alternate, partly clasping; flowers greenish white.
Found in waste places, prairies, etc. Not common.

AMMANNIA COCCINEA (long-leaved ammannia). July-September.
Annual 1-2 feet high, smooth; leaves opposite, narrow, with auricled base; flowers small, axillary, purplish.
Found on muddy banks, etc. Not common.

AMORPHA CANESCENS (lead plant). July-August.
Low shrubs 1-3 feet high, whitish-downy; leaves pinnate, leaflets 31-51; flowers purple, spikes clustered at the summit.
Found on dry hills, etc. Not common.

APIOS TUBEROSA (groundnut). July-September.
Perennial, twining 4-8 feet over bushes; leaves pinnate, with 3-9 leaflets; flowers purple, in short racemes.
Found in thickets, etc. Not common.

ARALIA RACEMOSA (spikenard). July-August.
Perennial; stem widely branched; leaves large, compound-pinnate; flowers greenish white.
Found on rich banks, etc. Not common.

ASCLEPIAS INCARNATA (swamp milkweed). July-September.
Perennial 3-5 feet high, smooth, very leafy; leaves rather narrow, smooth; flowers rose-purple or, rarely, white.
Found in swamps, etc. Common.

ASCLEPIAS VERTICILLATA (whorled milkweed). July-September.
Perennial 1-3 feet high, leafy-stemmed; leaves linear, in whorls of 3-6; flowers small, in lateral or terminal umbels, greenish.
Found in open woods, glades, etc. Rather common.

BIDENS BIPINNATA (Spanish needles). July-October.
Annual 1-3 feet high, smooth, branched; leaves 1–3-pinnately parted; flowers small, pale yellow; achenes 3–4-awned.
Found in damp soil. Common.

BIDENS FRONDOSA (beggar-tick). July-October.
Annual 1-3 feet high, branched; leaves 3–5-divided, smooth, terminal leaflets long-stalked; flowers yellow; achenes 2-awned.
Found in damp ground, etc. Very common.

BLEPHILIA HIRSUTA (hairy blephilia). July-September.
Perennial 1-2 feet high, hairy throughout; leaves round-heart-shaped; flowers pale with purple spots.
Found in moist shady places. Common.

BOLTONIA ASTEROIDES (aster-like boltonia). July-September.
Perennial 3-5 feet high, branching, smooth, pale green; leaves lanceolate, mostly entire; rays white, disk yellow.
Found in moist places, etc. Not common.

BRAUNERIA ANGUSTIFOLIA (pale cone-flower). July-October.
Perennial 2-3 feet high, hairy; leaves narrow, 3-nerved, entire; flowers large, rays long, yellow, disk purple.
Found in limestone glades, etc. Common.

CACALIA ATRIPLICIFOLIA (pale Indian plantain). July-September.

Perennial 4-6 feet high, smooth, glaucous; leaves alternate, palmately veined; flowers white.

Found in rich woods, etc. Common.

CACALIA RENIFORMIS (great Indian plantain). July-September.

Perennial 3-5 feet high; stem grooved and angled, not glaucous; leaves green on both sides, kidney-shaped; flowers white.

Found in rich damp woods, etc. Common.

CAMPANULA AMERICANA (tall bellflower). July-September.

Annual 3-6 feet high; leaves taper-pointed, serrate; flowers light blue.

Found in moist rich soil. Common.

CASSIA CHAMAECRISTA (partridge pea). July-September.

Annual 1-2 feet high, branched, smoothish; leaves pinnate, 10-15 pairs; flowers large, yellow.

Found on sandy hills, etc. Common.

CASSIA NICTITANS (wild sensitive plant). July-October.

Annual 10-15 inches high, branched, decumbent; leaves 10-20 pairs; flowers yellow.

Found in dry sandy soil. Not common.

CHRYSOPSIS VILLOSA (hairy golden aster). July-August.

Perennial 1-2 feet high, branched, villous-hairy; leaves narrowly oblong, hoary; flowers yellow.

Found on dry sandy hills, etc. Not common.

CICHORIUM INTYBUS (chicory). July-October.

Perennial 2-4 feet high; leaves partly clasping; flowers variable, blue, pink, purple, rarely white.

Found along roadsides, in old fields, etc. Not common.

CICUTA MACULATA (water hemlock). July-August.

Perennial 3-6 feet high; stem streaked with purple; leaves 2–3-pinnate, the lower on long petioles; flowers white.

Found in wet places. Common.

CLEMATIS VIRGINIANA (Virginia virgin's bower). July-September.

Perennial vines climbing 8-12 feet over bushes; leaves 3-foliate, thin, dark green, heart-shaped; flowers white, paniculate.

Found on rich banks, etc. Rather common.

COMMELINA COMMUNIS (creeping day-flower). July-October.

Perennial, slender, creeping, nearly smooth; spathe cordate; flowers blue.

Found on rich banks, etc. Common.

COREOPSIS TRIPTERIS (tall tickseed). July-October.

Perennial 4-6 feet high, smooth; leaves pinnately 3–5-divided, entire; rays yellow, disk brownish.

Found in open woods, banks, etc. Not common.

CROTONOPSIS LINEARIS (crotonopsis). July-September.
Annual 6-10 inches high, branched; leaves linear, green above, silvery beneath; flowers small, greenish white.
Found in dry sandy soil. Not common.

CUPHEA PETIOLATA (blue wax-weed, tar-weed). July-October.
Annual 1-2 feet high, viscid-hairy, branching; leaves lanceolate; flowers purple.
Found in dry woods, fields, etc. Common.

DESMODIUM NUDIFLORUM (naked-flowered tick trefoil). July-August.
Perennial 1-3 feet high; leaves crowded at the summit of the stem; flowers purple.
Found in dry woods. Common

DESMODIUM ROTUNDIFOLIUM (prostrate tick trefoil). July-September.
Prostrate perennial, soft-hairy all over; leaves 3-foliate; flowers purple.
Found in dry woods. Common.

DYSSODIA PAPPOSA (false dog-fennel). July-October.
Annual 8-12 inches high, nearly smooth, strong-smelling, much branched; leaves pinnately parted; flowers yellow, rays few.
Found in dry open places, etc. Not common.

ECHINOCYSTIS LOBATA (wild balsam-apple). July-September.
Tall climbing annual vine; leaves deeply and sharply 5-lobed; flowers greenish white.
Found in rich soil along streams. Not common.

ECLIPTA ALBA (eclipta). July-October.
Annual 10-20 inches high, rough; stems procumbent; leaves opposite, pointed at both ends; flowers white, anthers brown; achenes short, 3–4-sided.
Found on wet banks and in waste places. Not common.

ERECHTITES HIERACIFOLIA (fireweed). July-September.
Annual 3-5 feet high; stem grooved, rank-smelling; leaves alternate, cut-toothed, sessile; flowers whitish.
Found in moist woods, recently burnt clearings, etc. Not common.

ERYNGIUM YUCCIFOLIUM (rattlesnake master). July-September.
Perennial 2-4 feet high, branching above; leaves prickly; flower heads globose, bluish white.
Found on banks, open woods, etc. Not common.

EUPATORIUM PERFOLIATUM (boneset). July-September.
Perennial 2-3 feet high, hairy; leaves perfoliate; flowers white, in a large compound corymb.
Found in wet places. Not common.

EUPATORIUM URTICAEFOLIUM (white snakeroot). July-November.

Perennial 1-3 feet high, smooth, branching; leaves opposite, petioled, thin, serrate; flowers pure white.

Found in rich woods, etc. Common.

GAURA BIENNIS (biennial gaura). July-September.

Biennial 4-6 feet high, soft-downy; leaves alternate, sessile; flowers rose-color, spike long; fruit 4-angled.

Found on dry banks, etc. Common.

HEDEOMA PULEGIOIDES (mock pennyroyal). July-September.

Annual 4-8 inches high, branching, hairy; leaves oblong, serrate; flowers bluish, in few-flowered whorls.

Found in dry soil. Common.

HELIANTHUS HIRSUTUS (stiff-haired sunflower). July-October.

Perennial 3-6 feet high, bristly-hairy; leaves short-petioled, very rough above; flowers yellow.

Found in dry soil. Common.

HELIOPSIS HELIANTHOIDES (false sunflower). July-September.

Perennial 3-5 feet high, nearly smooth; leaves sharp-pointed; flowers yellow, showy.

Found on banks, in glades, etc. Common.

HIERACIUM GRONOVII (hairy hawkweed). July-September.

Perennial 1-3 feet high, hairy, leafy near the base; flowers yellow.

Found on flinty or sandy hills, etc. Not common.

HYPERICUM PROLIFICUM (shrubby St. John's-wort). July-September.

Shrubs 3-6 feet high, branchlets 2-edged; leaves narrowly oblong; flowers numerous, bright yellow.

Found on rocky banks. Not common.

ILYSANTHES DUBIA (false pimpernel). July-September.

Annuals 8-12 inches high, much branched, smooth; upper leaves partly clasping; flowers purplish, on slender peduncles.

Found in wet places. Rather common.

IMPATIENS BIFLORA (spotted touch-me-not). July-October.

Annual 2-4 feet high, smooth, branched; leaves ovate or oval, coarsely toothed; flowers orange-colored, spotted with brownish-red.

Found in wet, shady places. Rather common.

IMPATIENS PALLIDA (pale touch-me-not). July-September.

Annual, smooth, branching, 2-4 feet high; leaves ovate or oval, coarsely toothed; flowers pale yellow, sparingly spotted.

Found in rich soil, moist shady places. Not common.

IPOMOEA LACUNOSA (small white morning-glory). July-September.

Annual; stem slender, climbing; leaves entire or angled, lobed; flowers small, white.

Found on river banks, etc. Not common.

JUSSIAEA DIFFUSA (creeping primrose-willow). July-August.
Perennial; stem creeping or floating and rooting; leaves oblong, tapering into a slender petiole; flowers large, yellow.
Found in water or on muddy banks. Not common.

LACTUCA FLORIDANA (false or Florida lettuce). July-September.
Biennial 4-6 feet high, smooth; leaves lyrate or, rarely, entire; flowers blue.
Found in rich soil, etc. Common.

LACTUCA LUDOVICIANA (western lettuce). July-September.
Biennial 4-6 feet high, smooth, leafy; leaves sinuate-pinnatifid; flowers yellow, heads large.
Found in old fields, open woods, etc. Common.

LEONURUS CARDIACA (common motherwort). July-September.
Perennial 2-4 feet high; leaves long-petioled, the lower palmately lobed; flowers pale purple, in axillary whorls.
Found in waste places around old dwellings, etc. Common.

LIATRIS CYLINDRACEA (cylindric blazing star). July-September.
Perennial 1-3 feet high, nearly smooth; leaves linear; flowers rose-purple, rarely white.
Found in dry, open places. Not common.

LOBELIA CARDINALIS (cardinal-flower). July-September.
Perennial 1-3 feet high, smoothish, leafy; leaves oblong-lanceolate, slightly toothed; flowers large, scarlet.
Found in low wet ground, etc. Not common.

LOBELIA INFLATA (Indian tobacco). July-November.
Annual 1-2 feet high, pubescent, branched; leaves ovate, obtusely toothed; flowers white.
Found on dry, sandy or flinty banks. Not common.

LOBELIA LEPTOSTACHYS (spiked lobelia). July-August.
Perennial 1-2 feet high, slender, wand-like, leafy; leaves obtuse, thickish, upper reduced to awl-shaped bracts; flowers white, in spike-like racemes.
Found in sandy or flinty soil. Not common.

LOBELIA SIPHILITICA (great lobelia). July-October.
Perennial 1-3 feet high, somewhat hairy; leaves thin, acute at both ends, serrate; flowers large, blue, rarely white.
Found in low wet ground, etc. Common.

LUDWIGIA ALTERNIFOLIA (seedbox). July-September.
Perennial 1-2 feet high, smooth or nearly so, branched; leaves alternate, narrow, sessile; flowers axillary, yellow.
Found in wet woods and swamps. Not common.

LUDWIGIA SPHAEROCARPA (globe-fruited ludwigia). July-September.
Perennial 1-2 feet high, finely pubescent; leaves lanceolate or linear, tapering at base; flowers small, greenish.
Found in wet swamps, etc. Not common.

LYTHRUM ALATUM (wing-angled loosestrife). July-August.
Perennial 1-3 feet high; branches with 2-margined angles; leaves alternate, upper narrow; flowers purple, axillary.
Found in swamps and wet places. Not common.

MENTHA SPICATA (spearmint). July-September.
Perennial 1-2 feet high, nearly smooth; leaves lanceolate, serrate; flowers white.
Found in wet places. Not common.

NELUMBO LUTEA (American lotus, or pond-lily). July-August.
Perennial 2-3 feet high; leaves large, round-peltate; flowers large, pale yellow.
Found in ponds, lakes, etc. Common.

NEPETA CATARIA (catnip). July-November.
Perennial 2-3 feet high, downy, branched; leaves opposite, heart-shaped at base; flowers white, dotted with purple.
Found in waste places, etc. Common.

OENOTHERA FRUTICOSA (common sundrop). July-August.
Perennial, pubescent, erect; leaves linear-lanceolate; flowers yellow.
Found in dry, sandy soil. Not common.

PERILLA FRUTESCENS (perilla). July-October.
Annual 2-3 feet high, erect, branching, aromatic; leaves ovate, coarsely toothed; flowers white, small.
Found in dooryards, waste places, etc. Common.

PETALOSTEMUM CANDIDUM (white prairie clover). July-August.
Perennial 2-3 feet high, smooth; leaves lanceolate or linear, leaflets 7-9; flowers white, heads cylindrical.
Found in dry prairies, glades, etc. Rather common.

PETALOSTEMUM PURPUREUM (violet prairie clover). July-August.
Perennial 1-3 feet high, smooth; leaves linear, leaflets 5; flowers rose-colored, heads short.
Found in dry prairies, glades, etc. Rather common.

PHASEOLUS POLYSTACHYUS (perennial wild bean). July-September.
Perennial vine, twining to 10 feet; leaves 3-foliate, roundish, short-pointed; flowers purple.
Found in thickets, on banks, etc. Rather common.

PHLOX PANICULATA (garden phlox). July-September.
Perennial 2-3 feet high, smooth or nearly so; leaves ovate-lanceolate, pointed; flowers pink-purple, rarely white.
Found in open woods, etc. Not common.

PHRYMA LEPTOSTACHYA (lop seed). July-August.
Perennial 1-2 feet high, branched above; leaves coarsely toothed; flowers purplish, opposite, in elongated terminal spikes.
Found in moist open woods. Rather common.

POLYGONUM PENNSYLVANICUM (smart or knot weed). July-September.
Annual 2-3 feet high, branching above; leaves lanceolate: flowers bright rose-color, in short spikes.
Found in moist soil, open waste places. Common.

POLYMNIA UVEDALIA (large-flowered leafcup). July-August.
Perennial 4-6 feet high, rough-hairy; leaves broadly ovate, angled and toothed, lower winged-petioled; flowers yellow.
Found in rich soil. Rare.

PONTEDERIA CORDATA (pickerel-weed). July-October.
Perennial 1-2 feet high, smooth; leaves heart-shaped, blunt; flowers blue, in dense spikes, from a spathe-like bract.
Found in ponds, etc. Rare here.

PRENANTHES ALTISSIMA (tall white lettuce). July-October.
Perennial 2-4 feet high, smooth; leaves variable; flowers white, in small axillary or terminal clusters.
Found in rich, moist woods, etc. Rather common.

PYCNANTHEMUM FLEXUOSUM (narrow-leaved mountain mint). July-September.
Perennial 1-3 feet high, smooth, branching; leaves firm, linear; flowers white.
Found in dry ground. Common.

RUDBECKIA LACINIATA (tall cone-flower). July-September.
Perennial 4-6 feet high, smooth, branching; lower leaves with 5-7 leaflets, upper undivided; flowers yellow.
Found in low thickets, etc. Common.

RUDBECKIA SUBTOMENTOSA (sweet cone-flower). July-September.
Perennial 2-3 feet high, branching above, downy; lower leaves 3-lobed, serrate; rays yellow, disk brown.
Found in low, open woods. Rare.

RUDBECKIA TRILOBA (brown-eyed Susan). July-October.
Biennial 2-4 feet high, branching, hairy; lower leaves 3-lobed, upper ovate-lanceolate, sparingly toothed; flowers small, yellow, disk black-purple.
Found in rich soil. Common.

SABATIA ANGULARIS (square-stemmed sabatia). July-September.
Annual 1-2 feet high; stem smooth, 4-wing-angled, branched above; leaves ovate, with a clasping base; flowers showy, rose-pink, rarely white.
Found in rich sandy soil. Rare.

SAGITTARIA LATIFOLIA (broad-leaved arrow-head). July-September.

Perennial 1-2 feet high, smooth, angled; leaves broad, arrow-shaped; flowers white, in whorls.

Found in water or wet places. Common.

SCROPHULARIA MARILANDICA (figwort). July-September.

Perennial 4-6 feet high; stem square; leaves opposite, pointed, serrate; flowers greenish purple.

Found in rich woods, etc. Common.

SCUTELLARIA LATERIFLORA (mad-dog skullcap). July-September.

Perennial 1-2 feet high, smooth, much-branched; leaves lanceolate-ovate, pointed, serrate; flowers small, blue, rarely pink or white.

Found in wet shaded places. Not common.

SILENE REGIA (royal catchfly). July.

Perennial 1-3 feet high; stem roughish, erect; leaves opposite, thickish; flowers scarlet, in clusters forming a panicle.

Found in prairies and glades, etc. Rare.

SILPHIUM LACINIATUM (compass plant). July-September.

Perennial 4-8 feet high, rough-bristly, leafy; leaves pinnate, cut-lobed, large; flowers yellow, heads large, few.

Found in prairies, glades, etc. Common.

SILPHIUM PERFOLIATUM (cup plant). July-September.

Perennial 4-8 feet high; stem square, leafy; leaves perfoliate; flowers yellow.

Found in moist soil. Rather common.

SILPHIUM TEREBINTHINACEUM (prairie dock). July-September.

Perennial 4-6 feet high; stem smooth, slender, leafless except towards the base; leaves broad, somewhat heart-shaped, thick, rough beneath; flowers yellow.

Found in prairies, on banks, etc. Not common.

SOLIDAGO GATTINGERI (Gattinger's goldenrod). July-August.

Perennial 2-3 feet high, smooth, slender; leaves narrow, smooth beneath, rough above; flowers bright yellow.

Found in limestone, glades, etc. Rare.

SOLIDAGO GRAMINIFOLIA (bushy goldenrod). July-September.

Perennial 2-3 feet high, smooth, leafy, spreading by running rootstocks; leaves lance-linear; flowers yellow, small.

Found in moist soil, etc. Not common.

SOLIDAGO LATIFOLIA (broad-leaved goldenrod). July-October.

Perennial 1-2 feet high, smooth or nearly so; leaves broadly ovate, sharply serrate; flowers yellow, in axillary clusters.

Found in moist shaded banks. Common.

SOLIDAGO NEMORALIS (field goldenrod). July-November.
Perennial 1-3 feet high, grayish-pubescent; lower leaves long-petioled; flowers yellow, racemes numerous, dense.
Found in dry, open soil, old fields, etc. Very common.

SOLIDAGO ULMIFOLIA (elm-leaved goldenrod). July-September.
Perennial; stem smooth, branching; leaves thin, pointed, tapering to the base; flowers yellow, racemes panicled, recurved, spreading.
Found in dry rocky woods, etc. Common.

STROPHOSTYLES HELVOLA (trailing wild bean). July-October.
Prostrate or climbing annual 4-8 feet long; leaves ovate to ovate-oblong, terminal, 2-lobed; flowers greenish white and purple.
Found on banks, etc. Common.

STROPHOSTYLES UMBELLATA (pink wild bean). July-September.
Perennial; stem prostrate or climbing 4-8 feet; leaves ovate or oblong-linear, rarely lobed; flowers white and purple.
Found in damp soil, etc. Common.

SYMPHORICARPOS ORBICULATUS (coral-berry, buck bush). July.
Low shrubs 2-4 feet high, branching; flowers small, in dense axillary clusters, pinkish white; fruit red, small.
Found on rocky banks, roadsides, etc. Common.

TRICHOSTEMA DICHOTOMUM (blue curls). July-October.
Annual 8-16 inches high, branching, viscid-pubescent; leaves lance-oblong, short-petioled; flowers blue, small.
Found in sandy open places, etc. Not common.

VERBASCUM BLATTARIA (moth mullein). July-November.
Biennial 2-4 feet high, green, smoothish, slender; lower leaves petioled, serrate, some lyre-shaped, upper partly clasping; flowers yellow or white.
Found on roadsides, waste places, etc. Not common.

VERNONIA ALTISSIMA (tall ironweed). July-September.
Perennial 4-7 feet high, smooth, branching above; leaves lance-oblong; flowers purple, in loosely spreading cymes.
Found in rich, moist soil. Not common.

VERNONIA BALDWINI (Baldwin's ironweed). July-September.
Perennial 3-5 feet high, pubescent; leaves lance-oblong or ovate; flowers purple, head rather small.
Found in prairies, old fields, etc. Common.

VERNONIA FASCICULATA (western ironweed). July-September.
Perennial 3-5 feet high, smooth; leaves linear, green and nearly smooth beneath; flowers purple, heads rather small, crowded into a fastigiate cyme.
Found in prairies, etc. Not common.

AUGUST

ABUTILON THEOPHRASTI (velvet leaf). August-October.
Annual 3-6 feet high, velvety-pubescent; leaves roundish, heart-shaped, taper-pointed; flowers yellow.
Found in waste places, vacant lots, etc. Not common.

AMPHICARPA MONOICA (wild hog peanut). August-September.
Perennial, twining, nearly smooth; leaves 3-foliate, thin; flowers purplish, racemes nodding.
Found in rich, damp woods. Common.

AMPHICARPA PITCHERI (Pitcher's hog peanut). August-September.
Perennial, twining, hairy; leaves 3-foliate; flowers purplish, racemes villous-hairy.
Found in rich woods, thickets, etc. Common.

ASTER AZUREUS (sky-blue aster). August-October.
Perennial 2-4 feet high; stem rough, erect; branches slender; leaves rough, ovate-lanceolate; flowers blue, large, showy.
Found in woods, etc. Not common.

ASTER FURCATUS (forking aster). August-October.
Perennial 2-3 feet high, leafy to the forked summit; leaves ovate or elliptic, coarsely serrate, lower slightly cordate; flowers white.
Found in woods and on rocky banks. Rare.

ASTER LATERIFLORUS (calico aster). August-October.
Perennial 3-4 feet high, branched, more or less pubescent; leaves lanceolate, pointed, serrate in the middle; flowers numerous, small, white.
Found in thickets, fields, etc. Common.

ASTER MULTIFLORUS (dense-flowered aster). August-November.
Perennial 1-3 feet high, much branched, hoary-pubescent; leaves rigid, crowded, linear; flowers small, very numerous, white.
Found on dry hills, etc. Rare.

ASTER NOVAE-ANGLIAE (New England aster). August-October.
Perennial 4-7 feet high; stem stout, hairy; leaves numerous, clasping, lanceolate, entire; flowers large, violet-purple.
Found in moist ground. Not common.

ASTER OBLONGIFOLIUS (aromatic aster). August-October.
Perennial 1-2 feet high, glandular-puberulent, much branched above; leaves narrow, entire, partly clasping; flowers violet-purple, numerous, showy.
Found in glades, on rocky banks, etc. Common.

ASTER PANICULATUS (tall white aster). August-October.
Perennial 3-5 feet high; stem smoothish, branched; leaves oblong or lanceolate, serrate or entire; flowers white or purplish.
Found in wet meadows, thickets, etc. Common.

ASTER PATENS (purple aster). August-October.
Perennial 2-3½ feet high, rough-pubescent, with wide-spreading branches; leaves entire, with cordate, clasping base; flowers mostly solitary, terminal, blue.
Found in dry ground, open woods. Common.

ASTER SALICIFOLIUS (willow aster). August-October.
Perennial 2-3½ feet high, smooth, much branched; leaves firm, often scabrous, mostly entire; flowers pale purplish or white.
Found in low ground, etc. Common.

ASTER SERICEUS (silky aster). August-September.
Perennial 2-3 feet high, silvery, slender; leaves silvery white, lanceolate; flowers mostly solitary, rays purple, showy.
Found in prairies and on dry banks. Rare.

BIDENS ARISTOSA (western tickseed). August-October.
Annual 1-2 feet high, slightly pubescent; leaves pinnately 5–7-divided; flowers yellow, numerous, showy.
Found in wet places, old fields, etc. Very common.

BIDENS LAEVIS (smooth bur marigold). August-November.
Annual 1-3 feet high, smooth, branching; leaves tapering at both ends, finely serrate; flowers yellow, showy.
Found in swamps, ditches, etc. Not common.

BRICKELLIA GRANDIFLORA (large-flowered thoroughwort). August-September.
Perennial 2-3 feet high, nearly smooth, branched; leaves deltoid, cordate, dentate-serrate; flowers white.
Found on Missouri River banks. Rare.

CACALIA SUAVEOLENS (sweet-scented Indian plantain). August-October.
Perennial 2-3 feet high; stem grooved, smooth; leaves triangular, pointed, serrate, those of the stem on winged petioles; flowers white.
Found on river banks, rich woods, etc. Not common.

CASSIA MEDSGERI (wild or American senna). August.
Perennial 2-4 feet high, smooth; leaflets 7-10 pairs; flowers yellow; pods thickish.
Found in dry gravelly soil. Not common.

CIRSIUM ALTISSIMUM (tall roadside thistle). August-September.
Biennial 4-6 feet high; stem downy, branching; leaves rough-hairy above, whitened with close wool beneath, prickles weak; flowers purple.
Found in fields, roadsides, etc. Common.

EUPATORIUM COELESTINUM (mist-flower). August-October.
Perennial 1-1½ feet high, pubescent; leaves opposite, triangular-ovate, bluntly toothed; flowers blue, in compact cymes.
Found in rich, moist soil. Not common.

EUPATORIUM PURPUREUM (Joe Pye weed). August-September.
Perennial 3-6 feet high, smooth; leaves 3-6 in a whorl, thin, smoothish; flowers pale pink or whitish.
Found in low ground, thickets, etc. Not common.

EUPATORIUM SEROTINUM (late-flowering thoroughwort). August-September.
Perennial 3-5 feet high, bushy-branched; leaves ovate-lanceolate, pointed, coarsely serrate; flowers whitish.
Found in fields, along banks, etc. Very common.

GERARDIA ASPERA (rough purple gerardia). August-October.
Annual 1-1½ feet high, sparingly branched; leaves linear, rough; flowers purple.
Found in dry open places. Not common.

GERARDIA PEDICULARIA (fern-leaved foxglove). August-September.
Biennial 2-3 feet high, much branched, very leafy; leaves ovate-lanceolate, pinnatifid and cut-lobed, viscid pubescent; flowers yellow.
Found in dry woods. Rare.

GERARDIA SKINNERIANA (Skinner's gerardia). August-October.
Annual 1-1½ feet high, slender, branched; leaves filiform with revolute margins; flowers rose-purple.
Found in dry woods and hills. Common.

GERARDIA TENUIFOLIA (slender gerardia). August-October.
Annual 10-16 inches high, slender; leaves narrowly linear, flat; flowers rose-purple.
Found in dry open places. Rather common.

GNAPHALIUM POLYCEPHALUM (common cudweed). August-September.
Biennial 1-3 feet high, erect, woolly, fragrant; leaves lanceolate, tapering at the base; flowers white.
Found in old fields, dry woods, etc. Common.

HELENIUM AUTUMNALE (sneezeweed). August-October.
Perennial 2-3 feet high, nearly smooth; stem angled; leaves mostly toothed, decurrent on the stem; flowers yellow.
Found in moist rich ground, etc. Common.

HELIANTHUS GROSSESERRATUS (saw-toothed sunflower). August-October.
Perennial 4-8 feet high, smooth, glaucous, leafy; leaves long, taper-pointed, sharply serrate; flowers yellow.
Found near East St. Louis. Common.

HELIANTHUS MOLLIS (soft sunflower). August-September.
Perennial 3-5 feet high, soft-pubescent; leaves opposite, sessile. ovate, with broad-cordate base; flowers yellow, large.
Found on dry barrens, etc. Common.

HIBISCUS LASIOCARPOS (hairy-fruited rose mallow). August.
Perennial 4-6 feet high, soft-pubescent; leaves soft-pubescent, entire; flowers white or rose-colored, crimson-blotched at base.
Found on lake borders, swamps, etc. Common.

HIBISCUS MILITARIS (halberd-leaved rose mallow). August-September.
Perennial, 3-5 feet high, smooth; lower leaves ovate, heart-shaped. 3-lobed; flowers flesh-colored, with purple base.
Found in swamps, river banks, etc. Not common.

IRESINE PANICULATA (ghost weed). August-September.
Annual 2-4 feet high, erect, slender, nearly smooth; leaves ovate-lanceolate; flowers silvery white, in a panicle.
Found on banks of streams, etc. Rare.

LESPEDEZA CAPITATA (round-headed bush clover). August-September.
Perennial 2-4 feet high; stem stiff, tomentose; leaves with 3 oblong leaflets, silky on both sides; heads globular.
Found in dry or sandy soil. Not common.

LESPEDEZA PROCUMBENS (trailing bush clover). August-September.
Trailing perennial 2-3 feet high, soft-downy; leaves oval or elliptic; flowers on slender few-flowered peduncles.
Found in dry soil. Common.

LESPEDEZA REPENS (creeping bush clover). August-September.
Creeping perennial, smooth, slender; leaves smooth, narrow; flowers violet-blue.
Found in sandy or rocky soil. Common.

LIATRIS PYCNOSTACHYA (hairy button snakeroot). August-September.
Perennial 2-4 feet high; stem leafy; leaves linear-lanceolate; flowers rose-purple, spike dense, showy.
Found in prairies, open woods, etc. Not common.

LIATRIS SCARIOSA (large button snakeroot). August-September.
Perennial 3-5 feet high, hoary or pubescent; leaves rough, lanceolate, lower petioled; flowers rose-purple, large, scattered along the spike.
Found in dry soil, glades, etc. Common.

RUDBECKIA FULGIDA (orange-flowered cone-flower). August-October.
Perennial 1-2 feet high, branching; leaves 3-nerved, partly clasping; rays yellow, disk dark purple.
Found in open glades. Common.

RUDBECKIA SPECIOSA (showy cone-flower). August-October.
Perennial 1-3 feet high, rough-hairy, branched; lower leaves elliptic-ovate, upper lanceolate, pointed, coarsely toothed; flowers large, rays yellow, disk dark purple.
Found in open woods, banks, etc. Not common.

SILPHIUM INTEGRIFOLIUM (entire-leaved rosin-weed). August-September.
Perennial 3-6 feet high, smooth or rough; leaves opposite, rigid, thick; flowers yellow, in a forking corymb, short-peduncled.
Found in open woods, glades, etc. Common.

SOLIDAGO CANADENSIS (Canada goldenrod). August-November.
Perennial 3-5 feet high, glabrous below; leaves thin, glabrous above, serrate; flowers small, racemes dense.
Found in thickets and rich open places. Common.

SOLIDAGO RIGIDA (stiff goldenrod). August-October.
Perennial 2-4 feet high, rough and somewhat hoary, leafy; leaves oval or oblong, lower petioled, upper sessile by a broad base; flowers large, corymb dense.
Found in dry soil, glades, etc. Common.

SOLIDAGO RADULA (western rough goldenrod). August-September.
Perennial 1-3 feet high, stiff-rough, not hoary; upper leaves sessile, rigid, rough; flowers in upright racemes.
Found in limestone glades, etc. Rather common.

SOLIDAGO SEROTINA (late goldenrod). August-October.
Perennial 3-5 feet high, smooth, often glaucous; leaves smooth on both sides, serrate; flowers panicled.
Found in thickets, rich soil. Common.

SOLIDAGO SPECIOSA (showy goldenrod). August-October.
Perennial 2-4 feet high, stout, smooth below; leaves thickish, smooth with rough margins; flowers large, in erect racemes, showy.
Found in dry open woods. Rare.

VERBESINA HELIANTHOIDES (small yellow crownbeard). August-October.
Perennial 3-4 feet high; stem hairy, winged; leaves alternate, sessile, decurrent; flowers yellow, few.
Found in dry open woods, etc. Not common.

NOTES

The Women's Auxiliary of the St. Louis Medical Society held their first annual meeting in the lecture room at the Garden, June 5.

Recent visitors to the Garden were: Dr. Arthur P. Kelly, of the department of botany, Rutgers University, Brunswick, New Jersey; and Prof. J. A. Drushel, of New York University, New York City.

Dr. Hermann von Schrenk, Pathologist to the Garden, sailed for London, June 13, to represent the New York Central Lines, the Nickel Plate Road, and the Kansas City Southern Railway, as a delegate to the International Railway Congress.

Mr. G. H. Pring, Horticulturist to the Garden, returned from Europe recently after visiting the botanical gardens of England, Ireland, Scotland, Holland, Belgium and France, and the bulb fields of Holland. He also attended the International Flower Show, in Haarlem, and the Chelsea Flower Show, in London. A collection of orchids of botanical interest were obtained from the botanic gardens at Kew and Dublin, and many of the showy orchids were purchased from nurseries.

STATISTICAL INFORMATION FOR MAY, 1925

GARDEN ATTENDANCE:

Total number of visitors	27,252

PLANT ACCESSIONS:

Total number of plants received as gifts	170
Total number of seed packets received as gifts	118

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	33
Total number of books and pamphlets donated	247

HERBARIUM ACCESSIONS:

By Gift—

Bailey, Prof. L. H.—*Malvaviscus Conzatti* cultivated at Oneco, Florida	1
Bechtel, Prof. A. R.—*Stereum fasciatum* from North Carolina	1
Epling, Dr. Carl C.—Plants of California	4
Fancher, C. G.—*Juniperus* from Arizona	1
Glaeser, J. H.—*Amorphophalus* sp., cultivated at Trenton, Illinois	1
Kobuski, Clarence E.—Plants of New York	84
von Shrenk, Dr. Hermann—*Citrus* sp. from Arkansas	1
Urban, Dr. I.—*Senecios* from Cuba	2
Weedon, Amy G.—Fungi from Florida	9
Weir, Dr. J. R.—Fungi from Mexico	3

By Purchase—

Dutton, Dr. Lewis—Mosses, hepaticas and lichens of Vermont	165
Henderson, Professor L. F.—Plants of Oregon	196
Total	468

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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G. NINTEMAN,
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J. ULRICH,
Inside Floral Display

H. VALLENTINE,
Carpenter

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XIII SEPTEMBER, 1925 No. 7

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ST. LOUIS, MO.

1925

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A LAWN OF CREEPING BENT AT THE GARDEN.

Missouri Botanical Garden Bulletin

Vol. XIII SEPTEMBER, 1925 No. 7

A NEW LAWN GRASS FOR ST. LOUIS

The problem of securing a satisfactory lawn grass in St. Louis has always been a perplexing one and probably always will be unless more money and effort is devoted to it than the average individual is willing to spend. In the past about the best combination which had been devised for lawns in this region was a mixture of blue grass and red top with sometimes the addition of white clover. St. Louis lies at practically the southern boundary of the region in which blue grass will flourish and it is only during exceptional seasons that lawns made up chiefly of this grass can be said to be worthy of the name. One has only to observe the way in which blue grass grows in partially shaded locations to realize how delicate is the balance between success and failure during one of our average summers. Perfect stands of blue grass can frequently be found in St. Louis when they have been shaded during a part of the day by a tree or a building. At the Garden the outline of the shadow of a tree or shrubbery plantation is not infrequently marked by a beautiful patch of blue grass, whereas just beyond the shadow, little or no blue grass can be found.

Because of the unsatisfactory results with blue grass and red top, the Garden undertook some five years ago a series of experiments in the hope that possibly some more satisfactory lawn grass or combination of grasses might be obtained for St. Louis. Some thirty plots were started with different species or mixtures of grass and the results carefully noted from year to year. No special preparation of the soil

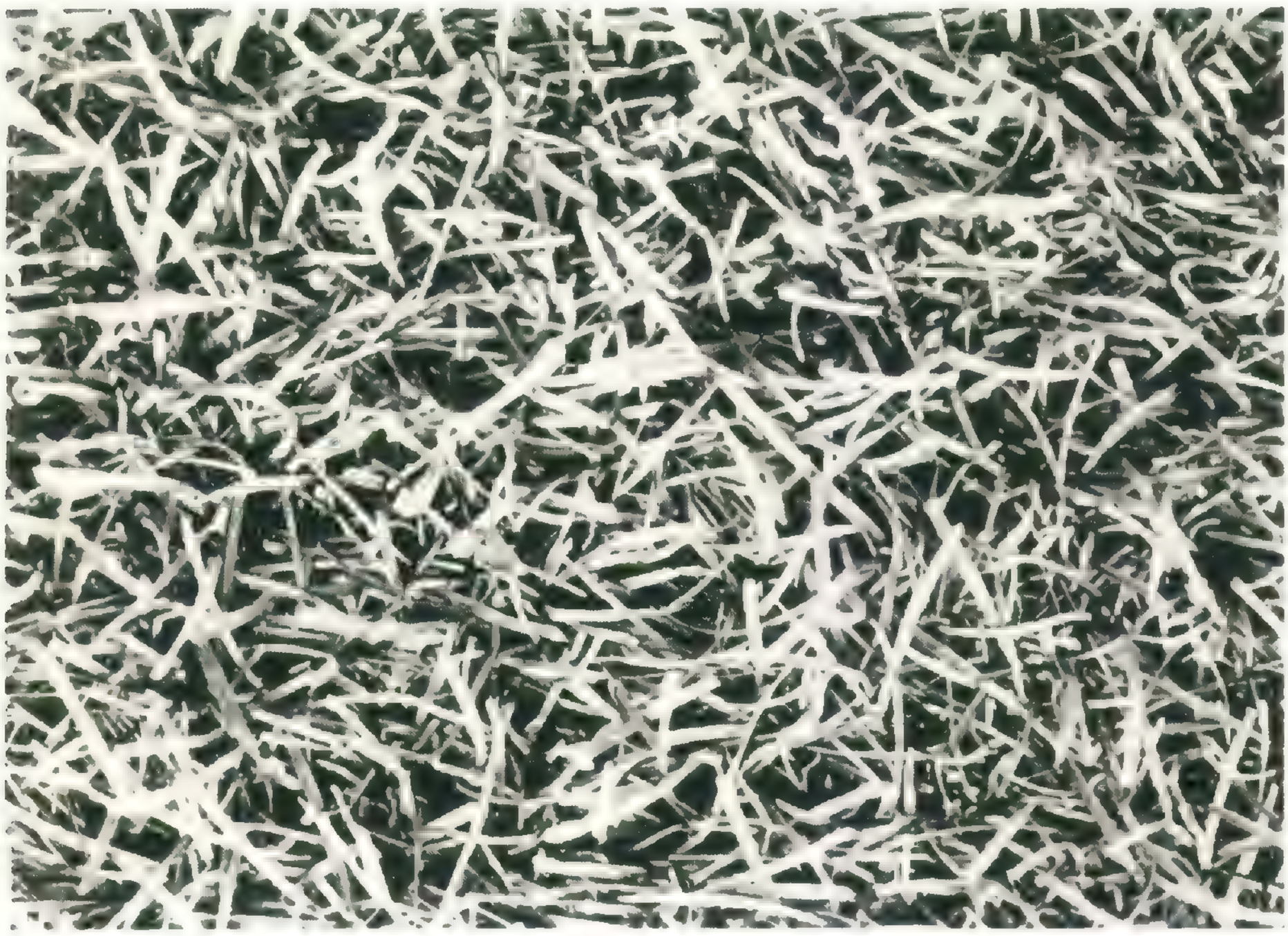
was attempted, and only average attention was given to cutting, watering, fertilizing, etc., nor was any hand weeding permitted, the object being, of course, to ascertain the variety of grass which will produce the best lawn under average conditions. It is quite possible that many of the grasses tested, if they had received extraordinary care and attention, might have given much better results. This, however, would not have afforded a fair test of the grass being grown for lawns. Without attempting at this time to give the results of all experiments, it very soon became evident that certain of the so-called bent grasses and fescues were best adapted to St. Louis conditions. Since the bents produce a much more pleasing lawn, so far as color is concerned, special attention was paid to this group, and, from our experience up to the present time, there seems to be no question but that one of the special strains of creeping bent comes more nearly answering the requirements of a grass for St. Louis lawns than any other with which we experimented. Whether or not a strain of velvet bent may ultimately be developed which will be superior to creeping bent remains to be seen. There is also a possibility that if it can be satisfactorily propagated the native dropseed grass, *Muhlenbergia diffusa* (pl. 25), may be admirably adapted for certain special localities.

What is creeping bent?—The term "bent" has been applied variously to different species of grass of the genus Agrostis. While there are a large number of species in this genus, only three or four are of any importance from the standpoint of lawn making. Red top *(Agrostis alba)*, Rhode Island bent *(Agrostis tenuis*, sometimes called *A. vulgaris)*, velvet or brown bent *(Agrostis canina)* are all more or less closely related species to the true creeping bent, namely *Agrostis stolonifera*. The seed which comes to this country as "German bent" or "creeping bent" is more properly termed "South German mixed bent," since it usually contains two to three kinds of Agrostis, together with various other grass seed. Some of these mixtures may contain a large percentage of red top or velvet bent and only a negligible quantity, if any, of the true creeping bent. Consequently, the use of this mixture

PLANTING THE CREEPING BENT AT THE GARDEN.

MO. BOT. GARD. BULL., VOL. 13, 1925.

CRAB GRASS.



BLUE GRASS.

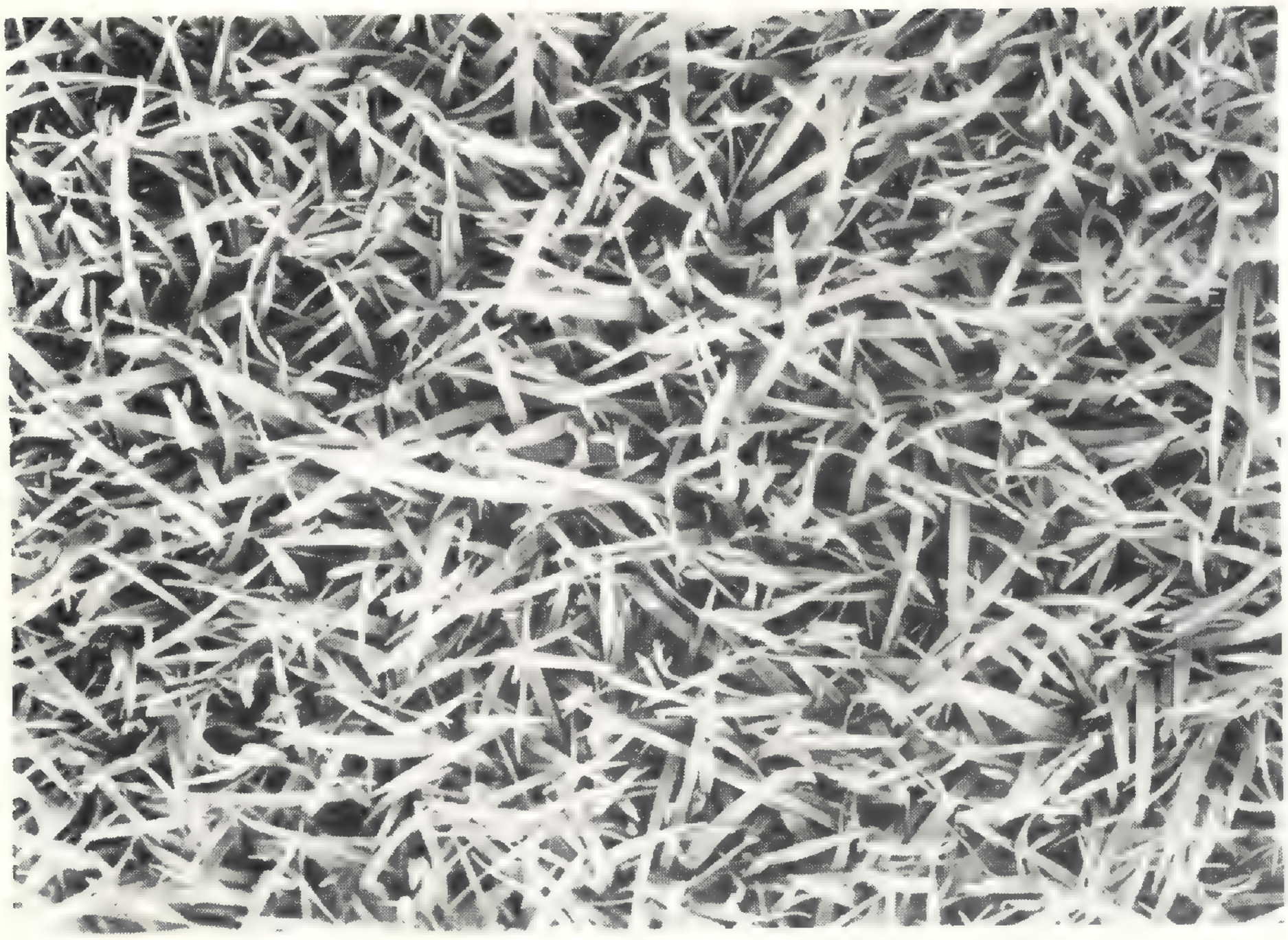
will not result in obtaining a lawn of pure creeping bent. As a matter of fact, there is practically no seed of the true creeping bent on the market, and the only way to secure a satisfactory lawn of this grass is by the use of stolons or underground stems referred to later in this article. To further complicate the matter there are something like a hundred varieties of the true creeping bent. Mainly through the activities of the Greens Committee of the United States Golf Association, in cooperation with the Department of Agriculture, there have been selected from this great number of varieties three or four which, because of their freedom from disease, resistance to adverse weather conditions, and quality of turf, stand out as being the grasses best adapted for putting greens and for lawns. For St. Louis the so-called "Washington strain" seems to give the best results, although it is probable that the "Metropolitan strain" is almost as well adapted for this region.

Preparation for planting.—In order to create a lawn of creeping bent the ground must be thoroughly prepared. If grass is growing on the land it should be removed with a spade, taking part of the soil so as to eliminate as much of the old grass and weed seed as possible. After thoroughly working the soil it should be raked level, and if of heavy clay a light dressing of well-rotted stable manure in the proportion of one yard to a thousand square feet may be incorporated in the upper six inches of the soil. The use of excessive amounts of stable manure should be avoided. In fact, the clay loam which abounds in this vicinity is well adapted for creeping bent, since one point in its favor is its ability to thrive under conditions which would not permit the growth of blue grass and similar lawn grasses. The only fertilizer which should be used is ammonium sulphate. This chemical applied at the rate of five pounds per thousand square feet before any planting is done will assist in producing an acid condition of the soil. The fact that acidity is one of the requisites for creeping bent, but is destructive to the common lawn weeds, constitutes one of the several advantages of this grass.

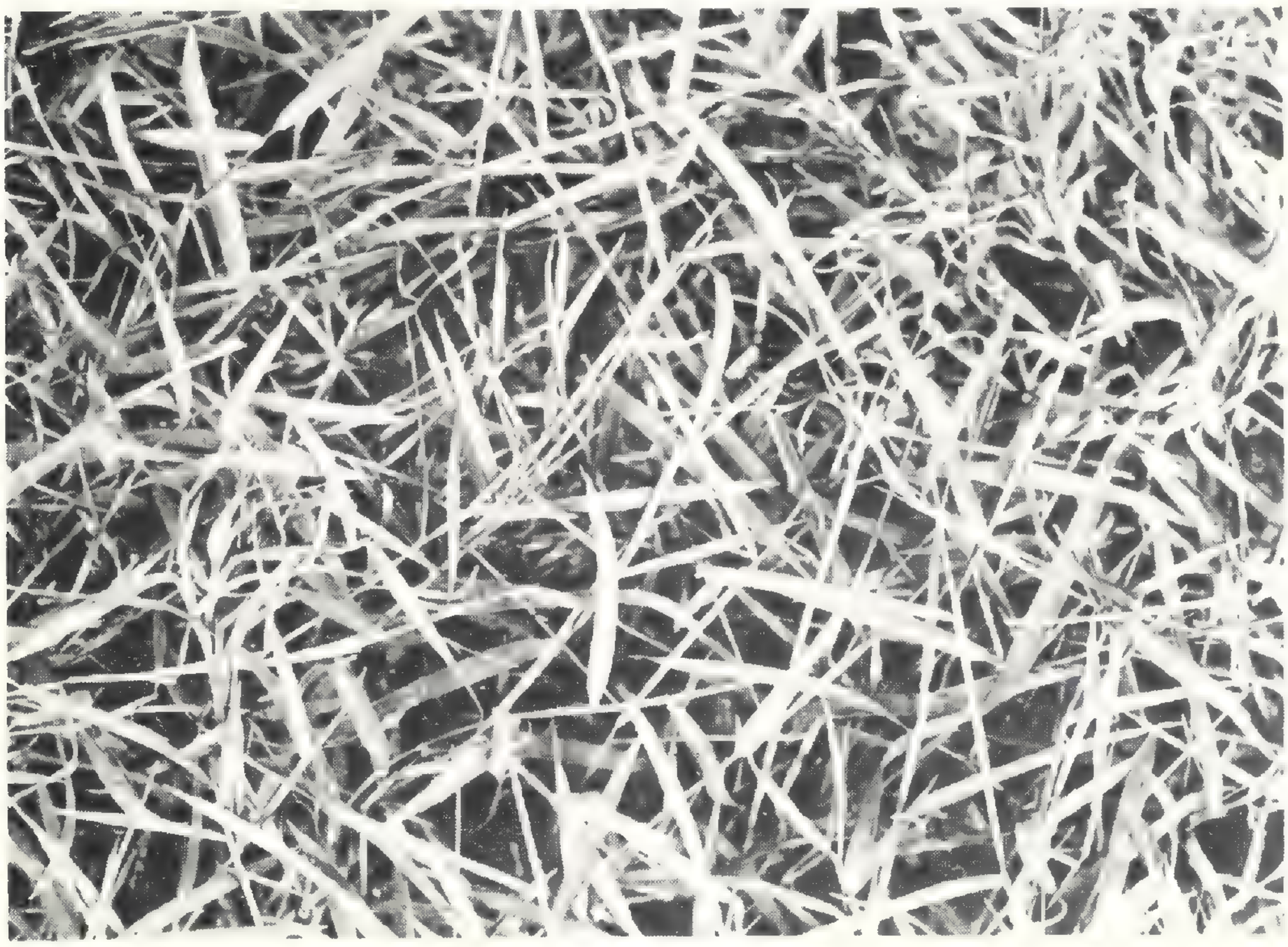
Planting of stolons.—A stolon is a creeping stem possess-

ing a series of joints from which new shoots and roots are developed. Creeping bent spreads by these jointed stems along the surface of the ground and differs from most grasses in having the ability to put out roots at these joints. Each joint, as it were, produces an independent plant. Chopped stolons of the Washington strain of creeping bent, as well as other strains, may be obtained from various nurseries in this country which now make a specialty of supplying this grass. In purchasing, one should be sure to deal with a reliable firm able to give every assurance of the genuineness of the strain. The stolons are shipped in bags ready for broadcasting over the prepared ground. If these stolons have dried out in transit they should be soaked in water before spreading and if hot weather is prevalent the ground should be well watered before broadcasting them. The pieces of creeping stem should be distributed as evenly as possible, and if immediate effects are desired there should be a piece for approximately every square inch of ground. This is at the rate of about one ten-quart bucket of chopped stolons to two hundred square feet of ground. They may be planted more sparingly than this, but much greater time is required to cover the area and a good deal more hand weeding will be necessary before the grass is thoroughly established.

As soon as the stolons are spread they should be immediately covered with screened soil. The tendency is to put on entirely too much of this top dressing. Do not bury the stolons completely but have portions of them visible above the soil, since many of the shoots will not be strong enough to force their way through a considerable thickness. From one-fourth to three-eighths inch of top dressing will be sufficient if the soil is dropped on the top of the stolons and not thrown from the side so as to roll underneath them. The object of this top dressing is not to bury the stolons as one would a seed or root, but to hold the pieces in place and prevent their drying out. The stolons would take root quickly and grow rapidly upon the surface of the soil without any covering whatsoever. After applying the top dressing the ground should be rolled and then watered. Watering with a fine spray is essential for the first two or three weeks, and



WASHINGTON BENT.



MUHLENBERGIA.

until the roots are well established the ground should not be allowed to become dry.

Subsequent care.—Early fall is the best time to establish a lawn of creeping bent in St. Louis. By the following April the stolons will have produced an almost perfect stand of grass. It will be found that creeping bent does not need to be cut nearly so often as a blue grass lawn, but this will have to be regulated by local conditions and the appearance desired. Some of the test plots in the Garden nursery were not cut throughout the season and yet presented a very satisfactory appearance. It is desirable to top dress the lawn with screened soil at the rate of from one to one and a half yards to 6000 square feet, at least once or twice during the season. If this can be done but once, the best time is probably late in the fall, when all mowing of the lawn is finished. As the creeping bent becomes well established it will tend to crowd out the annual grasses, but dandelion, plantain, and chickweed may be expected the first year and should be removed as rapidly as they appear. Later on, if enough fertilizer in the form of ammonium sulphate is applied, there will be no trouble from these common weeds.

The use of ammonium sulphate.—A peculiarity of creeping bent, as well as certain other bent grasses, is that it thrives in an acid soil rather than an alkaline one. Since most of the common lawn weeds will not grow in acid soil, a well-established lawn of creeping bent automatically eliminates one of the chief difficulties in keeping a presentable lawn. Most of the soils in the vicinity of St. Louis are either neutral or alkaline, and in order to get the best effect with creeping bent it is necessary to change the reaction of the soil to acid. This is most easily accomplished by the use of ammonium sulphate which acts as a fertilizer as well. To determine just when the soil has reached the right degree of acidity is not always easy, since the simple test sometimes resorted to of blue litmus paper turning red is entirely too unreliable. Tne most accurate method and the one which should be used if ammonium sulphate is to be applied intelligently is the bromcresol purple test. Place about a teaspoonful of soil in a small jar and add to this about four teaspoonsfuls of clear

rain water or distilled water. Ordinary city water which is strongly alkaline should not be used for any purpose in this test; in fact, all the utensils must be carefully rinsed with rain water or distilled water before using. Shake the soil and water thoroughly and then allow to settle for several hours. Rinse a white porcelain dish with distilled or rain water and into this put five or ten drops of the clear watery soil solution. This sample should be removed with a glass rod or tube which has been thoroughly rinsed. One ounce of a 1 per cent solution of bromeresol purple, which should be obtained from the drug store, is now added, a drop at a time, to the watery solution in the porcelain dish. If a clear bright yellow color results the soil is sufficiently acid to prevent the growth of common lawn weeds and at the same time is in the best condition for the creeping bent. Should the mixture assume a purplish or brownish color, however, the need for additional applications of ammonium sulphate is indicated.

It is not necessary that the proper acid condition of the soil be obtained before the stolons are planted, although, as indicated above, a fairly liberal application of ammonium sulphate at this time is an advantage. After the lawn is established an application of this chemical in the spring and fall is always beneficial and, aside from the fertilizing value, will tend to maintain the acid condition so necessary for perfect success. Ammonium sulphate should never be applied at a rate greater than five pounds per thousand square feet and in hot dry weather this should be cut in half. Experience would seem to show that there is little response from ammonium sulphate in the summer, and it is better not to attempt to use it at this time. The sulphate may be applied dry by simply sowing it over the ground, after which it may be washed in thoroughly by rain or the use of the garden hose. Such a method, however, is apt to result in very unequal distribution and may cause burning of the grass when the chemical is not thoroughly washed from the leaves. A much better way is to dissolve a pound of ammonium sulphate in ten gallons of water and apply this direct with a sprinkling can or any one of the various devices on the market for dis-

tributing fertilizer with a hose. Another very satisfactory method is to incorporate ammonium sulphate with the top dressing of the soil at the rate of one pound of the chemical to ten pounds of soil.

Diseases.—About ten years ago the so-called "brown patch" disease of creeping bent was first definitely recognized. Small brown spots, looking as though the grass had been scalded, appear at irregular intervals and spread indefinitely. A cobweb-like growth can usually be detected upon the blades of grass. This is due to a fungus which attacks numerous species, to which, fortunately, the Washington and Metropolitan strains of creeping bent are not nearly so susceptible as the other strains of this grass. This is one reason for being sure that the proper strain is obtained when buying stolons. Should the fungus appear, however, it can usually be controlled by the use of Bordeaux mixture. For the average individual the easiest way to apply this fungicide is to sprinkle the dry powder on the grass at the rate of one pound to 5000 square feet. The powder should lodge on the leaves and not on the roots; consequently it should be applied only when the dew is on the grass, or immediately after watering. A light top dressing of loam containing from one-half to one pound of ammonium sulphate to a thousand square feet, followed by immediate watering, is sometimes efficacious, and in mild attacks liberal watering in the morning is sufficient to destroy the fungus.

Another disease, known as "little brown patch", in contrast to the large brown patch above referred to, sometimes attacks creeping bent. These small patches, about the size of a dollar, do not enlarge but may occur so abundantly as to seriously affect the appearance of the lawn. This disease, the cause of which is not definitely known, does not respond to the Bordeaux treatment. The only remedy which seems to be effective is one of the mercuric compounds which are sold under the trade names of "Semisan" and "Uspulun." These chemicals, dusted on at the rate of one pound to six thousand square feet, applied as soon as possible after the disease is discovered, usually produce the desired result. If a sprinkling method is preferred, one pound dissolved in fifty gallons of

water, applied to two thousand square feet, followed by a light spray of water, may serve the purpose.

A top dressing of soil to which ammonium sulphate has been added is always recommended after a stand of creeping bent has been subjected to the attack of one of these diseases, since it aids materially in the recovery of the grass.

The advantages of the Metropolitan or Washington strain of creeping bent over any other lawn grass in this vicinity would seem to be:—the power to withstand admirably our hot, dry summers, and so far as our experiments have gone the alternate freezing and thawing of our winters; the ability to thrive well in acid soil, thus eliminating many of our common lawn weeds. This is a characteristic unique for a lawn grass, since all of the treatments recommended for blue grass, red top, etc., are equally beneficial to the growth of wild grasses, dandelion, plantain, etc. Finally, creeping bent does not have to be mowed as often as other grasses and needs less water after it is thoroughly established. As was pointed out in the February, 1925, BULLETIN, in an article on the "Feeding of plants with special reference to lawns," no stand of grass worthy of the name of lawn can be obtained without the expenditure of care and money, and after being once established it cannot be neglected any more than a flower or vegetable garden. If one is willing to follow the directions given and take the trouble to meet the requirements of the plants used for a lawn, it is believed that a greater degree of success can be obtained in this vicinity by the use of creeping bent than with any other grass known at the present time.

LIST OF MISSOURI WILD FLOWERS ACCORDING TO TIME OF BLOOMING

(Continued from June Bulletin)

SEPTEMBER

ASTER ERICOIDES (white heath aster). September-November.

Perennial 1-3 feet high, usually bushy, very variable; leaves firm, very variable; flowers white, numerous.

Found in dry soil, roadsides, lots, etc. Very common.

ASTER TURBINELLUS (prairie aster). September-October.
Perennial; stems slender, much branched, smooth below; leaves firm, lanceolate, entire; flowers blue, numerous, showy.
Found in dry soil, open woods, etc. Very common.

ASTER ANOMALUS (many-rayed aster). September-October.
Perennial 2-4 feet high; stem rough, stout, branched above; leaves thin, lower deeply cordate, nearly entire; flowers bright blue, large.
Found on limestone cliffs, etc. Not common.

ASTER CORDIFOLIUS (common blue wood aster). September-November.
Perennial 3-5 feet high; stem smooth, branched; leaves thin, rough, sharply serrate, lower ones cordate; flowers small, numerous, blue, rarely white.
Found in shaded woods, etc. Common.

ASTER DIVARICATUS (white wood aster). September-October.
Perennial 2-4 feet high; stem round, smoothish; leaves thin, smoothish, slender-petioled, closely dentate, variable; flowers white, disks turning brown.
Found in open woodlands, etc. Common.

ASTER DRUMMONDII (Drummond's aster). September-October.
Perennial 3-5 feet high; stem stout, finely canescent, branched above; leaves mostly thin, canescent beneath, sharply toothed; flowers blue, rather large.
Found in dry soil, prairies, glades, etc. Not common.

ASTER LAEVIS (smooth aster). September-October.
Perennial 2-4 feet high, smooth, glaucous; leaves thick, entire or nearly so, clasping; flowers blue, showy.
Found on dry limestone hills, in glades, etc. Not common.

EUPATORIUM ALTISSIMUM (tall thoroughwort). September-October.
Perennial 3-6 feet high, finely pubescent; leaves narrow, short-petioled, roughish; flowers white, in a much-branched top.
Found in dry open places. Rather common.

SOLIDAGO DRUMMONDII (Drummond's goldenrod). September-October.
Perennial 1-3 feet high; stem rough-pubescent; leaves thick, green on both sides, nearly smooth, sharply serrate; flowers yellow, on spreading or recurved branches.
Found on rocky cliffs, etc. Not common.

SOLIDAGO PETIOLARIS (downy ragged goldenrod). September-October.
Perennial 3-5 feet high; stem rather slender; leaves sessile or short-petioled, rough on the margins; flowers yellow, in a narrow or compound spike.
Found in dry soil, etc. Not common.

OCTOBER

CUNILA ORIGANOIDES (dittany). August-September.

Perennial 8-20 inches high, slender, stiff-branched; leaves sessile or very short-petioled; flowers pink-purple, in clusters.

Found in dry sterile soil. Common.

GENTIANA ANDREWSII (closed gentian). August-October.

Perennial 1-2 feet high, simple, leafy; leaves ovate-lanceolate, 3–7-nerved, rough-margined; flowers blue, rarely white.

Found in moist soil, swampy ground. Rare now.

GENTIANA FLAVIDA (white gentian). August-October.

Perennial 1-3 feet high; stem stout, round, smooth; leaves ovate-lanceolate, smooth-margined, clasping or rounded at base; flowers white.

Found in moist soil, etc. Rare.

GENTIANA PUBERULA (downy gentian). August-October.

Perennial; stem usually solitary, leafy, 8-18 inches high; leaves firm, lanceolate, rough-margined; flowers blue, showy.

Found in prairies, glades, etc. Rare here.

HAMAMELIS VIRGINIANA (witch-hazel). October-November.

Shrub 8-15 feet high; twigs slightly scurfy; leaves short-petioled, somewhat cordate, thick; flowers in axillary clusters, bright yellow.

Found on gravelly creek banks, etc. Not common.

PYCNANTHEMUM INCANUM (hoary mountain mint). August-October.

Perennial 2-3 feet high; stem pubescent; leaves thin-petioled, sharply serrate; flowers white.

Found in dry thickets, etc. Not common.

NOTES

Mr. G. H. Pring, Horticulturist to the Garden, spoke before the St. Louis Greens Committee, at the Algonquin Club, September 18, on "Grasses for St. Louis."

Dr. George T. Moore, Director of the Garden, spoke before the Northern Nut Growers' Association convention at St. Louis, September 22, on "Environmental Requirements of Nut Trees."

Dr. George T. Moore delivered a series of lectures on botanical subjects at the Rocky Mountain Laboratory of the Western State College of Colorado, at Gunnison, Colorado, July 6-10.

Dr. Hermann von Schrenk, Pathologist to the Garden, returned from Europe, September 17, where he attended the International Railway Congress and subsequently traveled in Belgium, France, Germany, Austria, Wales, and Switzerland, investigating matters dealing with timber preservation.

Among those visiting the Garden recently were Dr. W. H. Long, Forest Pathologist, in charge of pathological laboratory, Albuquerque, New Mexico; and Dr. C. J. Reed, professor of medical physiology, Baylor University Medical School, Dallas, Texas.

Dr. B. M. Duggar, Physiologist to the Garden, attended, on September 17, the meeting of the programme committee of the International Congress of Plant Sciences at Ithaca, New York.

Dr. B. M. Duggar has been asked to reorganize the research staff in botany at the Marine Biological Laboratory, Woods Hole, Massachusetts.

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1925

GARDEN ATTENDANCE:

Total number of visitors in June 17,717
Total number of visitors in July 19,443
Total number of visitors in August 41,591

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts in June 148
Total number of plants and seed packets received as gifts in July 174
Total number of seed packets received in exchange in August 7

PLANT DISTRIBUTION:

Total number of plants distributed as gifts in July..... 10

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June.. 42
Total number of books and pamphlets donated in June... 251
Total number of books bought in July..... 8
Total number of books and pamphlets donated in July.. 308
Total number of books and pamphlets bought in August 8
Total number of books and pamphlets donated in August 126

HERBARIUM ACCESSIONS:

JUNE

By Gift—

Allen, Mrs. J. F.—*Uvularia grandiflora* Sm. from Missouri 1
Bettis, Mrs. A. M.—Plants of Missouri..... 2
Epling, Dr. Carl C.—Plants of California..... 2
Florists' Publishing Company—Cultivated specimen of *Ipomoea versicolor* Meisn..... 1
Kellogg, John H.—*Anagalis arvensis* L. from Franklin County, Missouri 1
Posse, Miss Christine—*Coniferae* of New Mexico..... 10
Pring, G. H.—Plants of England..... 236
Schrenk, Hermann von, and Alfred Kammerer—*Abies lasiocarpa* (Hook.) Nutt. from New Mexico..... 3

By Exchange—

Drushel, Professor J. A.—North American plants..... 70
Gray Herbarium of Harvard University by Dr. B. L. Robinson—*Priva* sp. from British East Africa..... 1
Payson, Dr. E. B.—Plants of Colorado and Utah..... 22

By Purchase—

Holzinger, John M.—*Musci Acrocarpi Boreali-Americani*, Fasc. xxii Nos. 526-550	25
Merrill, G. K.—*Lichenes exsiccati*, Nos. 1-50	50
Total	424

JULY

By Gift—

Bettis, Mrs. James R.—*Sabatia angularis* (L.) Pursh, a white-flowered form from St. Louis County, Mo.	1
Bettis, Mrs. James R.—*Cassia* sp. from horticulture	1
Fuller, Dr. George D.—*Synthyris rubra* Benth. from Alberta	1
Ridgway, Robert—Plants of Illinois	30
Wagner, Rev. A.—Plants of Missouri	3

By Purchase—

Henderson, Prof. L. F.—Plants of Oregon	323
Total	359

AUGUST

By Gift—

Florists' Publishing Company—*Cassia Medsgeri* Shafer.	1
Posse, Miss Christine—Plants of New Mexico	39
Sudworth, George B.—*Abies arizonica* Merriam, Colorado	1
Terry, Mrs. C. E.—Cultivated specimen of *Physostegia virginiana* (L.) Benth	1

By Purchase—

Porsild, Dr. Morten P.—Plants of Greenland	104
Werdermann, Dr. E.—Plants of Chile	376

By Field Work—

Greenman, Dr. J. M.—Plants of Jefferson County, Mo.	15
Total	537

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Missouri Botanical Garden Bulletin

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1925

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OF THE MISSOURI BOTANICAL GARDEN

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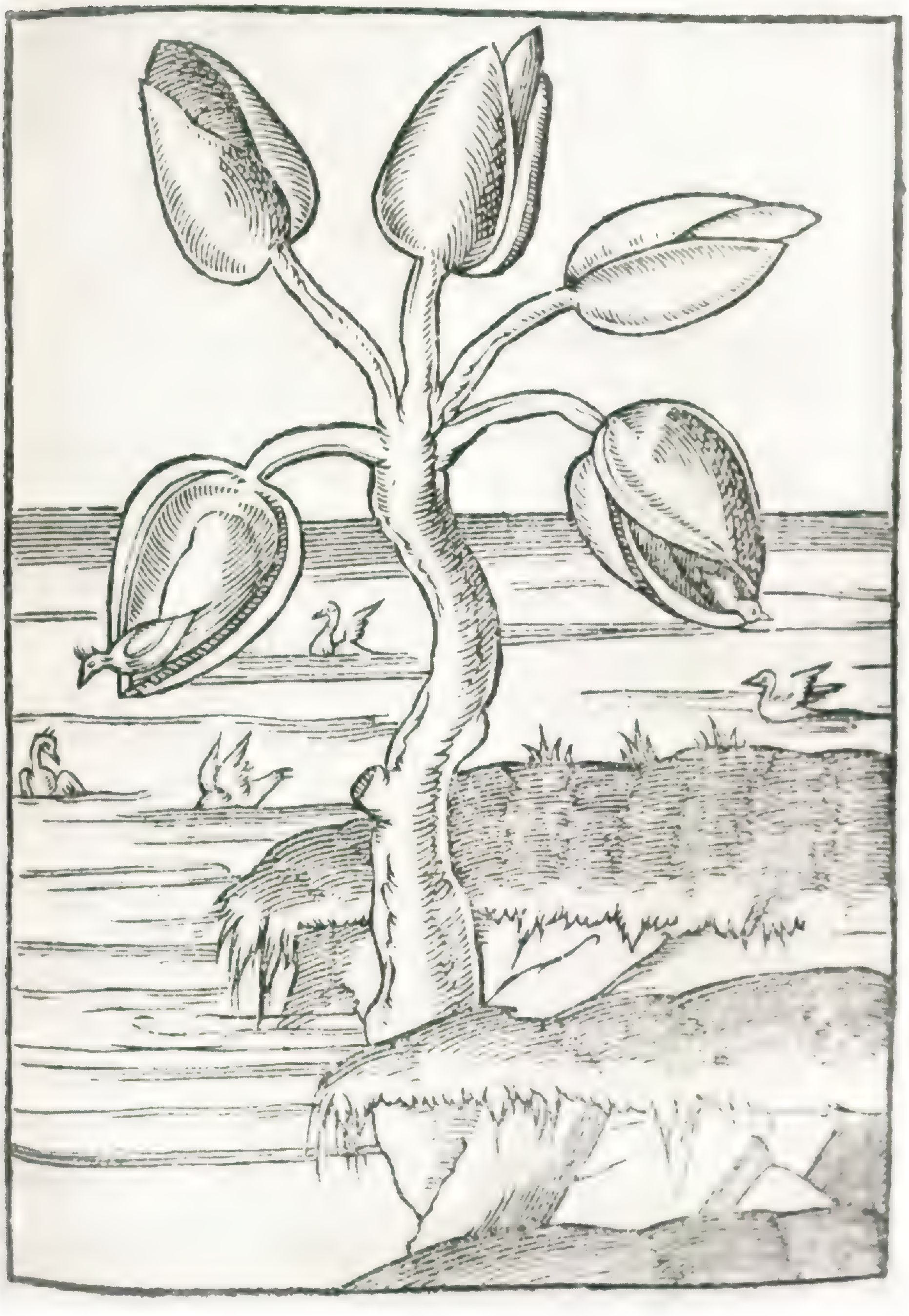


Missouri Botanical Garden Bulletin

Vol. XIII OCTOBER, 1925 No. 8

THE VEGETABLE LAMB

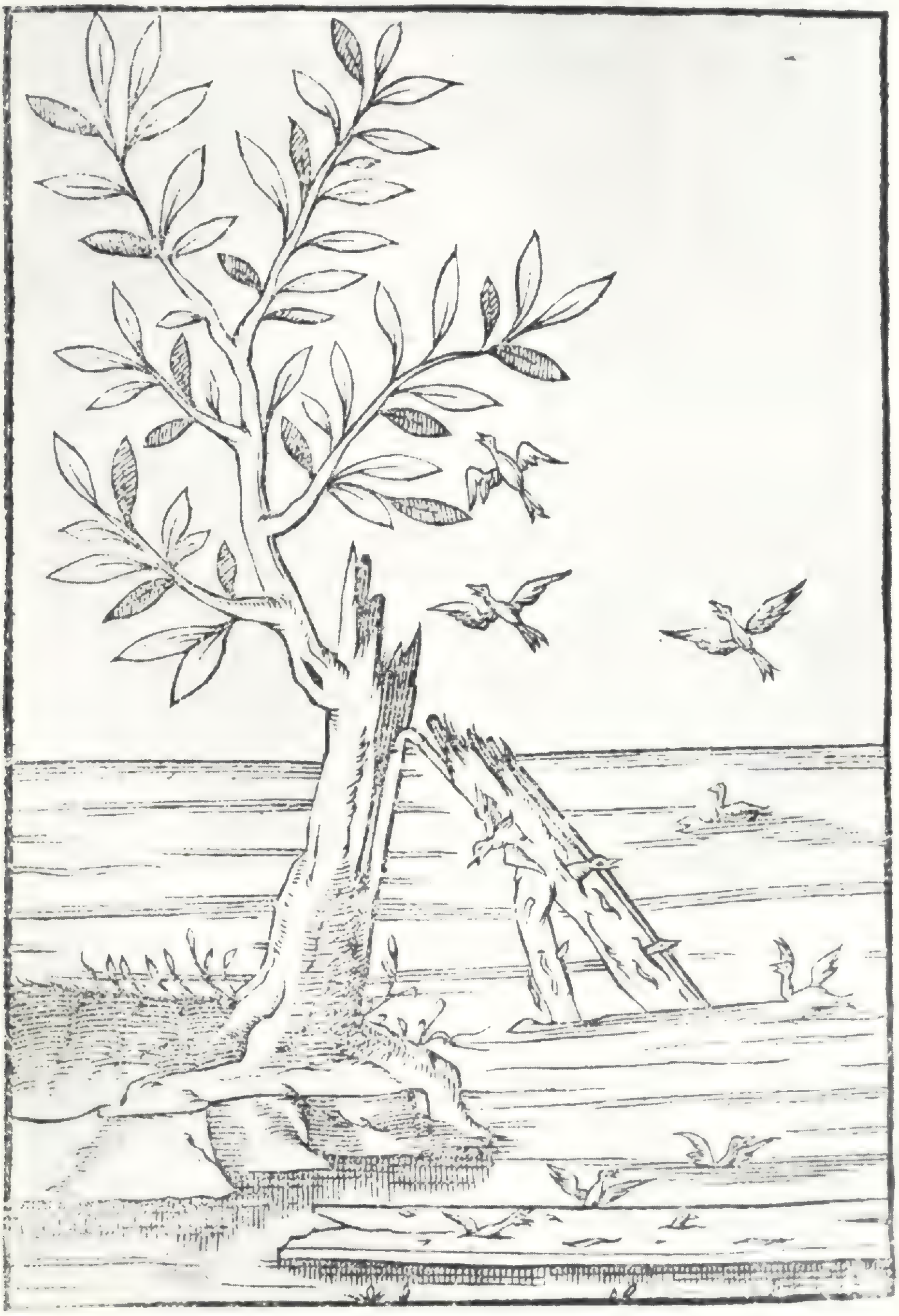
In ancient times, and even during the middle ages, it was a common belief that many forms of life could originate *de novo*. Among the early Greeks, Anaxymander of Miletus held that animals were formed from moisture and Empedocles believed that all living things arose through spontaneous generation. Aristotle, while not accepting this theory in its entirety, asserted that: "Sometimes animals are formed from putrefying soil, sometimes from plants, and sometimes in the fluids of other animals". He also stated that every dried substance which becomes moist and every moist body which becomes dry produce living creatures, provided it is fit to nourish them. Ovid defended this doctrine at length and in the middle ages we have a Flemish alchemist giving directions for the artificial production of mice. If an old piece of cloth and some seed corn were placed in a jar and allowed to stand a proper length of time, mice would surely be produced.

From the twelfth to the seventeenth century it was almost universally believed that certain geese of which the nesting places were unknown were hatched from barnacles which grew along the seashore, attached to pieces of old timber. In 1678 Robert Moray published in the Philosophical Transactions of the Royal Society of London an account of the examination of these barnacles, and he reported that: "In every one he had opened he found a little bird, the little bill like that of the goose, the eyes marked, the head, breast, tail, wings and feet formed, the features everywhere perfectly shaped and blackish color, and the feet like those of other water fowl".

The botanist, Girard, in 1597 stated that he had actually witnessed the transformation of the "shell fish" into geese. Plate 26, which attempts to illustrate this process, is taken from an interesting little book in the Missouri Botanical Garden library, written by Claude Duret, entitled "Histoire admirable des plantes et herbes esmerueillables & miraculeuses en nature", published in 1605. Other pictures taken from this same work illustrate how widespread was the belief that animals were capable of originating directly from plants (plates 27-29).

Perhaps the most curious of these myths was that concerned with the vegetable lamb of Tartary, sometimes called the Scythian Lamb, and again boramets or barometz, the latter being the Tartar word for lamb. This lamb was described as being at the same time both a living plant and a true animal. It was supposed to grow in the land of the Tartars of the East, formerly called Scythia, and the natives of this country wove materials for their garments and headdresses from the fleece of these vegetable lambs. While accounts vary somewhat, the one most generally accepted held that a living lamb was attached by its navel to a short stem rooted into the earth. The stalk on which the lamb was suspended above the ground was sufficiently flexible to permit the animal to bend over and browse on the herbage within reach. When all the grass had been consumed, the stem withered and the lamb died. A typical picture of the Boramets is seen in plate 30, also taken from the Claude Duret work, although a much more familiar one is that found in the background of the frontispiece of Parkinson's "Paradisus Terrestris" (plate 31). Of the Scythian lamb, Parkinson says: "This strange living plant as it is reported by divers good authors groweth among the Tartares about Samarkand and the parts thereabouts, rising from a seed somewhat bigger and longer than a Melon seede, with a stalk about five palmes high without any leafe thereon but onely bearing a certaine fruite and the toppe in forme resembling a small lambe, whose coate or rinde is woolly like unto a Lambe's skinne, the pulp or meat underneath which is like the flesh of a lobster, having it is sayed blood also in it; it hath the forme of an head hanging

Portrait de l'Arbre, lequel estant pourry, produit des vers, puis des canards viuans & volans.



Portraict de l'Arbre qui porte des fueilles, lesquelles tombant sur terre se tournent en oyseaux volants, & celles qui tombent dans les eaux se muent en poissons.

downe and feeding on the grasse round about it until it hath consumed it and then dyeth or else will perish if grasse round about it bee cut away of purpose. It hath foure legges also hanging downe. The wolves much affect to feede on them''.

The story of this wonderful plant seems to have been first brought to public notice in England during the reign of Edward III, by Sir John Mandeville. Between the years 1322 and 1356, Mandeville visited practically every part of the then known world and a full account of his journeys was written by him in English, French and Latin. By the middle of the seventeenth century the belief in the Scythian lamb, at least among men of learning, had practically disappeared, although in the meanwhile numerous travelers had testified to the authenticity of this freak of nature. Even after the animal nature of this plant had been regarded as fantastic and untrue, efforts were made to discover the basis of such a myth and discussion and speculation along this line continued until the end of the nineteenth century.

An early explanation of the origin of the vegetable lamb myth was given by Kaempfer, who had visited Persia and sought in vain for some trace of this monstrosity. About the beginning of the eighteenth century he published an account of his travels, and hazards the theory that examples of the Tartarian lamb then to be found in museums were nothing but the dried and shrunken skins of baby lambs which had lost all resemblance to an animal membrane and consequently were supposed to be of vegetable origin.

Another stage in the history of this curious fiction was reached in 1698, when Sir Hans Sloane presented to the Royal Society an object which has generally been regarded as a specimen of true vegetable lamb. ''This was more than a foot long, as big as one's wrist, having seven protuberances, and towards the end formed foot stalks about four or five inches long exactly like the root stalks of ferns. Most parts of these are covered with a down of a dark yellow snuff color, some of which was a quarter inch long. In Jamaica are many tree ferns which grow to the bigness of trees and have such a kind of *lanugo* on them, which seem to be shaped by art to imitate a lamb, the roots or climbing parts being made to resemble a

body and the extant foot stalks the legs." There is no question but that the specimen presented by Sir Hans Sloane was a portion of one of the tree ferns, but there was considerable doubt as to whether this could really be regarded as the true vegetable lamb. Plate 32 is taken from the figure illustrating Sir Hans Sloane's account in the Philosophical Transactions.

At a later date Dr. John Philip Bruyn, of Dantzic, addressed the Royal Society of London on the general aspect of the Scythian lamb and accompanied his communication with a specimen which obviously has the same natural origin as the one of Sir Hans Sloane. Dr. Bruyn says: "A certain learned and observant man passing through our city who is returning from a journey through Muscovy enriched my museum with, amongst other natural curiosities, one of these 'Scythian Lambs' which he declared to be the genuine Borometz. It was about six inches in length and had head, ears and four legs. Its color was that of iron rust and it was covered all over with a kind of down like the fibers of silk plush, except upon the ears and legs which were bare and of a somewhat darker tawny hue. On careful examination of it I discovered that it was not an animal production, nor yet a fruit, but either the thick creeping root or the climbing stem, of some plant which by obstetric art had acquired the form of a quadruped animal. For the four legs which look as though the feet had been cut off from them, were so many stalks which had supported leaves, as were also those which formed the ears and which more nearly resembled horns. The fibers emerging from these, by which, like other plants, this root or stalk had conveyed nutriment, left no doubt upon this point. Close inspection also showed that one of the front legs had been artificially inserted, and that the head and neck were not of one continuous substance with the body, but had been very cleverly and neatly joined onto it. In fact this root or stem had been skillfully manipulated into the form of a lamb in the same artful manner as the little figures of men which, it was said, shrieked and dropped human blood when drawn from the ground, were formed from the roots of mandragore and bryony." (See plate 33).

Later investigations have proved that both of these speci-

Portrait de l'Arbre qui produit de ses fruits Canards
vivants & vollants.

330

Hiſtoire admirable
Portraict du Boramets de Scythie ou Tartarie.

mens were manufactured from the root stalk of a fern of the genus Dicksonia, and since it had not previously been described and was supposed to have given origin to the fable of the Scythian lamb, it has been called *Dicksonia Barometz*.

It appears that the inhabitants of southern China occasionally converted the thick root stalk of this tree fern into a rough semblance of a quadruped, and this by those who were familiar with the story of the Scythian lamb was supposed to be the lamb. The identification of the material from which these four-legged animals were fashioned is positive, but in recent years grave doubts have been expressed about connecting these root-stalk animals with the vegetable lamb of Scythia. In 1887 Henry Lee published at length under the title "The Vegetable Lamb of Tartary" concerning the proper interpretation to be placed upon this curious myth. He examined carefully all the references in the literature and traces the development of the story to the similarity of appearance of two really different things, much like the fable which arose about the barnacle geese. Mr. Lee believes that the cotton pod of India furnishes the sole basis for the development of the story of the vegetable lamb. How easily this myth may have grown from the description of the cotton plant by ancient authors is shown by the following quotations from Herodotus: "Certain trees bear for their fruit fleeces surpassing those of sheep in beauty and excellence", and Pliny says: "These trees bear gourds the size of a quince which burst when ripe and display balls of wool out of which the inhabitants make cloths like valuable linen." This plant, according to Dr. Ure, "would be universally regarded as a miracle of vegetation did not familiarity blunt the moral feelings of mankind. This class of plants, largely distributed over the torrid zone, affords to the inhabitants a spontaneous and inexhaustible supply of the clothing material best adapted to screen their swarthy bodies from the scorching sun, and to favor the cooling influence of the breeze, as well as cutaneous exhalation. While the tropical heats change the soft wool of the sheep into a harsh scanty hair unfit for clothing purposes, they cherish and ripen the vegetable wool, with its more slender and porous fibers, admirably suited for clothing in a hot climate, as the grosser

and warmer animal fibers are in a cold one. No sooner does the cotton pod arrive at maturity than its swollen capsules burst with an elastic force, in gaping segments, in order, as it were, to display to the most careless eye their white fleecy treasure, and to invite the hand of the observer to pluck it from the seeds, and to work it up into a light and beautiful robe. Thus held forth from the extremity of every bough, by its resemblance to sheep's wool it could not fail to attract attention."

As cotton fabrics found their way from India by caravan through Tartary into Russia, they naturally attracted much attention and in countries where cotton did not grow this vegetable "lambs wool" might very readily have been associated in the minds of the ignorant with the body of an animal which grew attached to the soil. Indo-Scythia, beyond the western Himalayas, was regarded as the home of these "fleeces of vegetable wool, softer and whiter than that of the lamb" for the plant-animal which bore them. Henry Lee concludes his discussion as follows: "Thus the story of the Scythian or Tartarian lamb grew and was exaggerated and distorted until all traces of its origin were so obliterated that even men of thought and learning have been unable to recognize in the misleading descriptions given of it, the plant which, excepting corn, is perhaps the most valuable to mankind. For, as I have said, it seems to me to be clear and indubitable that the fruit which bursts when ripe and discloses within it 'a little lamb' was the cotton pod, and that the soft white delicate fleeces of the vegetable lamb of Scythia was that which we still call cotton wool.' "

POISONOUS PLANTS OF MISSOURI

Frequent inquiries are received at the Garden for information as to the poisonous properties of plants, and it is believed that the information here given will be of assistance to those interested in the subject. The plants listed are either native to Missouri or have been introduced for such a length of time that they are widely distributed. Only flowering plants are

FRONTISPIECE OF PARKINSON'S "PARADISUS TERRESTRIS" SHOWING SCYTHIAN LAMB IN BACKGROUND.

FIG. 4.—RHIZOME OF A FERN, SHAPED BY THE CHINESE TO REPRESENT A TAN-COLOURED DOG, AND LAID BEFORE THE ROYAL SOCIETY BY SIR HANS SLOANE AS A SPECIMEN OF THE "BAROMETZ," OR "TARTARIAN LAMB."

From the 'Philosophical Transactions,' vol. xx. p. 861.

referred to. Poisonous fungi, such as the Amanitas, were discussed in the August, 1917, number of the BULLETIN. Nor are those plants listed which cause so-called "hay fever," since this is a subject of itself and will be taken up in a subsequent number of the BULLETIN. The authority for most of the poisonous properties given is Pammel's "Manual of Poisonous Plants."

ACTAEA SPICATA (baneberry).

The berries are supposed to have an action on the heart, and the root is a violent purgative, irritant, and emetic.

AESCULUS GLABRA (Ohio buckeye).

Leaves and fruit are said to be poisonous to stock at certain seasons of the year. Fatal cases of the poisoning of children from eating the fruit are reported.

AILANTHUS GLANDULOSA (tree-of-heaven).

The bark is known to be poisonous, and handling the flowers causes an irritation of the skin to some persons. An apparently authentic case is reported of poisoning from water which had come in contact with the roots and leaves of this tree.

ANTHEMIS COTULA (May-weed, dog fennel).

Causes blistering of the skin. Carefully avoided by stock.

AGROSTEMMA GITHAGO (corn cockle).

Frequently found in wheat fields, and several cases of poisoning from flour containing cockle are on record. Said to be especially poisonous to poultry.

ASCLEPIAS SYRIACA (milkweed).

Poisonous to stock.

BAPTISIA LEUCANTHA (large white false indigo).

Generally avoided by stock. When taken in large doses is violent emetic.

CANNABIS SATIVA (hemp).

Resinous secretions of this plant possess properties which probably are not especially different from the Indian hemp (*Cannabis indica*). It is a depressant and produces delirium and a number of other effects.

CATALPA SPECIOSA (hardy catalpa).

Flowers produce irritation of the skin. It is doubtfully reported that it is dangerous to inhale the odor of the flowers for a long time.

CEPHALANTHUS OCCIDENTALIS (button bush).

Leaves contain a poisonous substance.

CHENOPODIUM AMBROSIOIDES (wormseed).

Cases of poisoning from the oil of the seed, which is a narcotic, have been reported.

CICUTA MACULATA (cowbane).

Numerous deaths, particularly among children, have been reported from eating the roots, and cattle are likewise poisoned. The poison occurs more particularly in the root, but also in the stem and leaves. The roots have been mistaken for parsnips. Reported to be more toxic in the fall, winter, and spring than in the summer.

CROTALARIA SAGITTALIS (rattle box).

Hundreds of horses have been killed both from eating this plant in the meadow and in hay. The disease is known as "Missouri bottom disease."

CYPRIPEDIUM HIRSUTUM (showy ladyslipper).

Affects the skin of some persons similarly to poison ivy.

DATURA STRAMONIUM (Jimson weed).

Children have been poisoned by eating the seed, although all parts of the plant are poisonous. Hay containing the plant is poisonous to cattle.

DELPHINIUM CONSOLIDA (field larkspur).

Frequently cultivated as an ornamental plant, having been naturalized from Europe. It contains several poisonous alkaloids and is fatal to cattle.

DIRCA PALUSTRIS (leather-wood).

The fresh bark applied to the skin produces sores quite difficult to heal. The berries are poisonous.

EUONYMUS ATROPURPUREA (waahoo, burning bush).

The European species have long been regarded as poisonous, and *E. atropurpurea* probably contains a powerful poison affecting the heart.

EUPATORIUM URTICAEFOLIUM (white snakeroot).

Said to produce the disease known as "trembles" in cattle, horses, and sheep, and "milk sickness" in people using milk or butter from affected cows. The latter is doubtful, however.

FRAGARIA VESCA (strawberry).

Occasionally produces a rash resembling scarlatina; likewise in some people produces irritation of the stomach.

GYMNOCLADUS DIOICA (Kentucky coffee tree).

The fruit contains a sweetish pulp which, as well as the leaves, is poisonous. When mixed with milk it is used as a fly poison.

HELENIUM AUTUMNALE (sneezeweed).

The whole plant is poisonous to cattle and sheep. It was used by the Winnebago Indians for colds and to produce sneezing.

Fig. 5.—Rough model of a tan-coloured dog, shaped by the Chinese from the rhizome of a fern, and submitted to the Royal Society by Dr. Breyn as a specimen of the "Scythian Vegetable Lamb."

From the 'Philosophical Transactions,' No. 390.

HERACLEUM LANATUM (cow parsnip).
Said to be poisonous, although the leaves of the fresh plant are eaten by Indians. The juice will produce blisters.

IMPATIENS BIFLORA (jewel-weed, spotted touch-me-not).
The plant is an emetic and is suspected of being poisonous to stock.

IRIS VERSICOLOR (blue flag).
The root contains substances which, if eaten, would prove seriously, if not fatally, poisonous.

JUNIPERUS VIRGINIANA (red cedar).
Said to poison goats which browse upon it.

LAPORTEA CANADENSIS (wood nettle).
Produces an irritation of the skin similar to that caused by common nettle.

LINARIA VULGARIS (butter-and-eggs).
Although no authentic cases of poisoning are known from this plant, it is regarded with suspicion.

LOBELIA INFLATA (Indian tobacco).
Produces nausea and great perspiration, and in large quantities causes convulsions and death.

MACLURA POMIFERA (osage orange).
Handling of the fruit and leaves produces irritation of the skin.

NICOTIANA TABACUM (tobacco).
Various opinions are expressed as regards its poisonous properties. Contains the alkaloid nicotine which, in sufficient quantities, affects the heart.

OXALIS VIOLACEA (violet wood sorrel).
Although the leaves of this plant are frequently eaten as a salad, at least one authentic case of serious poisoning, resulting in violent convulsions, is reported from eating a considerable quantity.

OXYPOLIS RIGIDIOR (cowbane).
The roots and leaves are known to be poisonous to men and are said to poison cattle.

PEDICULARIS CANADENSIS (lousewort).
Said to poison sheep.

PHYTOLACCA DECANDRA (pokeweed).
Although the young shoots are eaten as greens, the roots and seeds contain a very poisonous substance. The roots are sometimes taken for parsnips, artichokes, or horseradish, and eating large quantities has proved fatal.

PODOPHYLLUM PELTATUM (May apple).
The ripe fruit may be eaten in small quantities, but the root, stem, and leaves are known to be poisonous. It is said that when eaten by cows the milk may be injurious. The roots are irritating to the skin and mucous membrane.

POLYGONUM HYDROPIPEROIDES (knotweed, wild water-pepper).
Said to be poisonous to sheep.

PRUNUS SEROTINA (wild black cherry).
The flowers, when past their prime, give off a cyanide-like odor which causes headache to many people. The flesh of the fruit is not poisonous, but the seeds and leaves contain a substance which is fermented into hydrocyanic acid, and consequently it is extremely dangerous. Fatal results to children from eating seed. The wilted leaves are more poisonous than the fresh leaves, and stock has been killed by eating them.

PYRUS CORONARIA (wild crab-apple).
Poisonous properties similar to those of the following species.

RADICULA ARMORACIA (horseradish).
Should not be eaten in large quantities. The irritating properties possessed by this plant may produce serious symptoms.

RANUNCULUS ABORTIVUS (small-flowered crowfoot).
Acts in warm-blooded animals as a narcotic, producing stupor and slow respiration. Larger quantities may produce paralysis, convulsions, and death. Leaves of the plant cause blistering of the skin.

RHUS TOXICODENDRON (poison ivy).
While some persons are more or less immune to ivy poisoning, others are so susceptible that death has resulted (see September, 1924, number of the BULLETIN).

RICINUS COMMUNIS (castor-oil plant).
The oil from this plant is not poisonous, but the seed contain the deadly poisonous substance, ricin. Three seeds have been sufficient to cause death in man, and sheep and horses have been killed by it. The seed are sometimes used for poisoning moles.

ROBINIA PSEUDO-ACACIA (black locust).
The roots, leaves, and bark are very poisonous to man, the toxic substance being similar to ricin.

RUDBECKIA LACINIATA (golden-glow or tall cone-flower).
Poisonous to sheep.

RUMEX ACETOSELLA (sheep or field sorrel).
Said to be poisonous to horses and sheep.

SAMBUCUS CANADENSIS (common elder).

Has dangerous properties which, for the most part, have not been recognized. Children eating the leaves or flowers were saved only by vigorous treatment. Berries and flowers known to kill fowls which feed upon them. The young buds are especially poisonous.

SANGUINARIA CANADENSIS (bloodroot).

The root is poisonous and in sufficient quantities causes paralysis and death. It is sharply irritating to mucous surfaces.

SIUM CICUTAEFOLIUM (water parsnip).

Is reported as poisonous from various localities.

SOLANUM CAROLINENSE (horse nettle).

The root, as well as the fruit of the plant, has a disagreeable narcotic odor and is reported as possibly poisonous.

SOLANUM NIGRUM (black nightshade).

The leaves and other parts of the plant are reported as poisonous to calves, sheep, cows, and swine, and the green berries are known to be poisonous to man.

SOLANUM TUBEROSUM (potato).

Tubers of the potato when green are poisonous to many people. Serious results have followed the eating of the young green tubers, freshly dug.

SPIGELIA MARILANDICA (Indian pink or pink root).

Contains a toxic principle which has been used for medicine and in sufficient quantities may be quite poisonous. It is especially fatal to children.

TANACETUM VULGARE (tansy).

Very poisonous, having produced many serious and fatal cases in man, but poisoning of animals is rare.

TEPHROSIA VIRGINIANA (goat's rue).

Used by Indians as a fish poison. The root, leaves, and stem contain the poisonous principle.

TRIFOLIUM REPENS (white clover).

Produces bloat in cattle.

TRILLIUM ERECTUM (birth wort, wake robin).

All species are emetic in their action, and the root stalk is somewhat poisonous.

URTICA GRACILIS (slender nettle).

Produces irritation of the skin similar to that produced by stinging nettle.

NOTES

Recent visitors to the Garden include the classes from the St. Louis School of Pharmacy, and the delegates attending the convention of the American Public Health Association.

Dr. Leo Joseph Klotz, formerly Rufus J. Lackland Fellow at the Garden and later assistant professor of botany at the University of New Hampshire, has been appointed to a National Research Council fellowship in the biological sciences.

Number 1 of Volume 12 of the Annals of the Missouri Botanical Garden has recently been issued with the following contents: "Monograph of the Genus Monardella" and "Studies on South American Labiatae," by Carl Clawson Epling.

STATISTICAL INFORMATION FOR SEPTEMBER, 1925

GARDEN ATTENDANCE:

Total number of visitors	15,964

PLANT ACCESSIONS:

Total number of plants received as gifts	53
Total number of seed packets received as gifts	31

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	25
Total number of books and pamphlets donated	14

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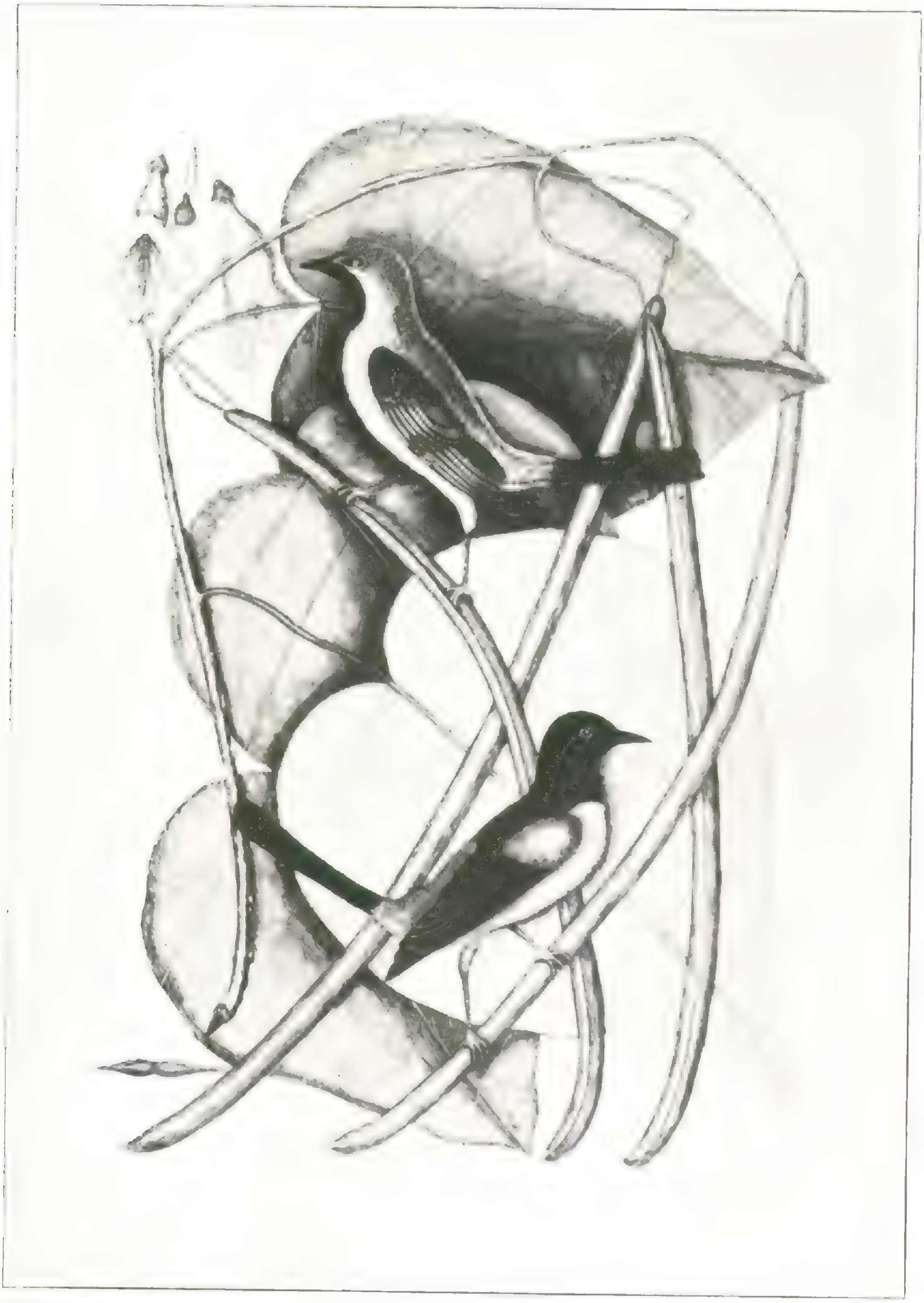


FIRST ILLUSTRATION OF THE CATALPA, FROM CATESBY'S "NATURAL HISTORY OF CAROLINA."

Missouri Botanical Garden Bulletin

Vol. XIII NOVEMBER, 1925 No. 9

WHEN AMERICAN PLANTS FIRST WENT TO EUROPE

In the days before Quarantine No. 37 placed its restrictions on plant importations, the far corners of the earth were systematically searched for new plants for American gardens. In this connection it is interesting to turn to some of the older books in the Garden library and read the accounts of early botanical exploration in this country. Just as Saint Louis audiences have been interested by Mr. Pring's story of his hardships in collecting orchids in South America, so English gardeners were listening two hundred years ago to plant explorers who had penetrated the American wilderness. One of these was Mark Catesby who discovered, among other things, the catalpa, and introduced it into cultivation (pl. 34). "The Catalpa Tree", he says in his "Natural History of Carolina", "is usually a small tree, seldom rising above twenty feet in height. * * * In May it produces spreading bunches of tubulous flowers like the common Fox-glove. * * * This Tree was unknown to the inhabited parts of *Carolina*, till I brought the seeds from the remoter parts of the country. And tho' the inhabitants are little curious in Gardenin, yet the uncommon beauty of the tree has induced them to propagate it; and 'tis become an ornament to many of their Gardens."

Though the earlier explorers did not come over specifically for plants, nearly all of them carried back roots and seeds to the mother country. Within half a century of the

discovery of the New World material had accumulated to such an extent that by 1574 Dr. Nicholas Monardes, a Spanish physician, prepared a treatise on the medicinal uses of American plants. This was translated into English a few years later and published, with additions, under the title of "Joyfull newes out of the newe founde worlde."

When the "First Plantation" was founded in Virginia in 1585, Thomas Hariot, a brilliant mathematician and astronomer, and a close personal friend of Sir Walter Raleigh, was sent over to report on the condition of the colony and the resources of the country. In his report he discussed "Suche Commodities as Virginia is knowne to yeelde for victuall and sustence of mans life, usually fed upon by the naturall inhabitants as also by us during the time of our aboad." The following extracts are typical. "Pagatowr, a kinde of graine so called by the inhabitants; the same in the West Indies is called Mayze. English men call it Guinney wheate or Turkie wheate, according to the names of the coutreys from whence the like hath been brought. The graine is about the bignesse of our ordinary English peaze and not much different in forme and shape; but of diuers colours; some white, some red, some yellow, and some blew. All of them yealde a very white and sweete flowre; being used according to his kinde it maketh a very good bread. Wee made of the same in the countrey some mault, wherof was brued as good ale as was to be desired. So likewise by the help of hops thereof may bee made as good Beere. It is a graine of marueillous great increase * * * There is also another great hearbe in forme of a Marigolde, about sixe foote in height; the head with the floure is a spanne in breadth. Some take it to bee *Planta Solis;* of the seeds herof they make both a kinde of bread and broth."

John Evelyn, the famous diarist, was also a gardener and arboriculturist. In his "Silva, or Discussion of Forest Trees" he enthuses over American trees, saying of our common arbor vitae: " * * * the leaf being bruised between the Fingers emits a powerful *Scent* not easily conquered, seeming to breathe something of a *sanative ungent*". Nor does he think the possibilities of American exploration exhausted for we

find him adding: "One thing more there is, I would encourage all imaginary Industry of such as travel in *foreign* countries and especially *Gentlemen* who have concerns in our *American Plantations*, to promote the culture of such *Plants* and *Trees* (especially Timber) as may yet add to those we find already agreeable to our climate."

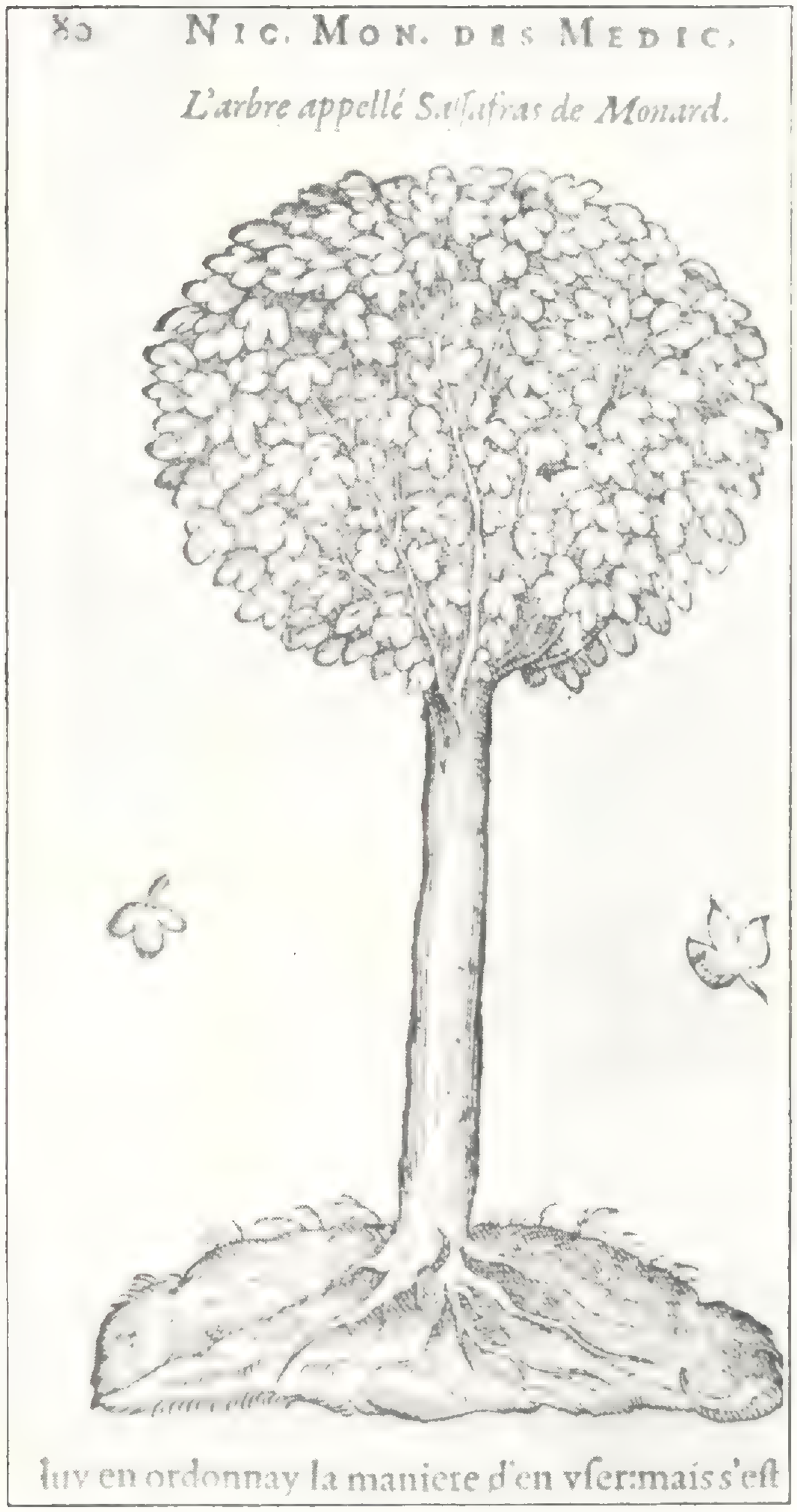
At first many of the New World plants were thought to have properties nothing short of miraculous. Chief among these panaceas was the sassafras (*Sassafras variifolium* Ktze.), whose aromatic qualities and the fact that the Indians were already using it for medicine immediately recommended it to the herb doctors (pl. 35). The first-known description is by Monardes in quaint sentences which are often two pages long. The following translation is somewhat abridged: "A certain sort of wood which comes from the province of Florida in the new world has been recently brought to Spain. It was given me by a certain Frenchman who told me its great virtues and properties for certain diseases. He obtained it from other Frenchmen who had obtained it from the Indians in Florida. The French having been driven out of this province, we Spanish, because of the bad meats and evil waters as well as having been forced to sleep without cover, began to fall victim to just such diseases as those with which the French had been afflicted, and having no other remedies, having been told by certain Frenchmen who had lived in Florida, of the virtues and properties of this wood, they used them and were quickly healed. This wood is called by the Indians 'Pauame' and by the French, who quit the country because of the Spanish, 'Sassafras.' I do not know the reason for the name. It is a large tree, about the size and form of a mediocre pine. It has a single trunk, leafy to the summit, seeming to be just like a pine which has been clipped. Its bark is covered with a slight skin, gray fading into black. Its taste is tart but aromatic, and it reminds one somewhat of the taste of fennel. Just a little of the wood will fill a room with an odor. Great care is to be used in its decoction. It is used against all kinds of diseases, principally obstructions and to invigorate and strengthen the internal organs, and also against fevers, and they make use of it also

with great profit when mixed with sugar for those that are troubled with asthma and for those who are sick in the chest caused by cold winds and consequently for nephritic ills.''

Monardes gives several directions for making medicine from the wood. The following is the simplest recipe: ''Take a half ounce of sassafras broken into little pieces and cook them in three measures of water until half boiled away. Use this decoction not only at dinner but also at supper and breakfast. Those who are not able to abstain from wine will be able to take it by mixing it with a little wine.'' Nor was Monardes the only one to recommend the new drug. Gerarde's ''Herball'' says of sassafras: ''It is a tree that groweth neere unto the sea and in temperate places that haue not much drought nor moisture. There be mountaines full of them, and they cast forth a most sweet smell, so that at the beginning when they saw them first, they thought they had been trees of Cinnamon * * * The wood hereof cut in small pieces and boyled in water, to the colour of Claret wine, and drunk for certain daies together, helpeth the dropsie, remoueth oppilation, cureth quotidian and tertian agues and long fevers.''

With advertising like this it is not surprising that the tree became popular. Captain John Smith included a stock of the wood in his first cargo. His sailors stole biscuits from the mess in order to trade with the Indians for a stock of the wood. The Queen's agents even sent special instructions to the young colony in Virginia to send back a good supply.

Another tree to enjoy a European boom was our black locust (*Robinia Pseudo-Acacia* L.). William Cobbett, a brilliant, self-educated English publicist, spent a period of enforced exile in America during the latter part of the eighteenth century. Here be became acquainted with the locust and upon his return to England bent his energies to popularizing the tree. He wrote voluminously in the press, predicting that the tree, once established, would drive all others from the market. With the help of influential friends he established a nursery and sold trees by tens of thousands. An account from a contemporary French publication shows that



THE EARLIEST-KNOWN ILLUSTRATION OF THE SASSAFRAS.

SEED POD OF POINSETTIA

THE POINSETTIA (EUPHORBIA PULCHERRIMA).

the tree was not without its admirers on the continent. "The False-Acacia makes a beautiful and large tree which is loaded down at the end of the month of May with beautiful grape-like clusters of white flowers of a very agreeable odor. The False-Acacia deserves to be employed in the decoration of spring shrub beds. In parks one could not search for greater elegance. A collection of these trees when trimmed will make a pretty sight in flowering time and they will suffice to perfume an entire garden."

On the other hand, certain crops which later proved more important than the sassafras or the black locust were not received well at first. The tomato and potato, inasmuch as they belonged to a family (the Solanaceae) which contains many poisonous plants, met with a particularly cool reception. The Europeans, not knowing how to grow the new crop, scattered the tubers broadcast, as they did their other seeds, and in some cases this led to the development of a poison in the exposed tubers. As a result the crop gained favor very slowly, and in Burgundy its use was even forbidden by law. In 1700 we find them recommended in an English work as "a pleasant food boiled or roasted, and eaten with butter and sugar." However, the food habits of a nation are not easily changed and fifty years later we find Miller writing the following in his Gardeners' Dictionary for 1754. "This Plant * * * was little cultivated till of late; these roots being despised by the Rich and seemed only proper Food for the meaner Sort of Persons; however, they are now esteemed by most People; and the quantity of them cultivated near London, I believe, exceeds that of any other part of Europe."

THE POINSETTIA

One of our most popular Christmas flowers is the poinsettia, *Euphorbia pulcherrima*. Its attractive dark green foliage and brilliant red bracts in a star-shaped, flower-like cluster at the top of the stem makes it a noteworthy addition to the plants blooming at the holiday season.

The poinsettia was first introduced into cultivation in 1828 by Dr. Joel R. Poinsette, of Charleston, South Carolina, who

was at that time American Minister to Mexico. Dr. Poinsette discovered the red variety in Mexico and sent plants to Robert Buist, a Scotch nurseryman in Philadelphia, who in 1834 forwarded some of his stock to Mr. James McNab of the Royal Botanic Garden, Edinburgh, Scotland. Professor Graham of the University of Edinburgh introduced the plant into England. The white variety, *Poinsettia pulcherrima albida*, was discovered in 1835 about 400 miles from the City of Mexico by William Bates who sent his collection to Charles Taylure, Goxteth Park, near Liverpool. It seems strange that Dr. Poinsette did not discover the white variety at the same time he found the red one, the explanation probably being that the var. *albida* was not indigenous to the locality in which he collected plants. In 1872 the double form, *Euphorbia pulcherrima plenissima*, was found in an Indian village near the Mexican state of Guerrero by Mr. M. Roezl Benedicte who sent plants to Mr. Isaac Buchanan, a millionaire florist of New York. The pink variety of poinsettia is supposed to have been originated by Albert Trebst of Merseburg, Germany, as a sport from *P. pulcherrima albida*. The red, pink, and white varieties are all used commercially, the red being the most extensively grown of the three.

Mr. Robert Buist, in the "Gardener's Chronicle," relates his observations of the poinsettia in the Bartram Botanic Gardens and on the estate of Isaac Buchanan:

"On my arrival in this country from the Royal Botanic Gardens, Edinburgh, in 1828, I paid a visit to the famed Bartram Botanic Gardens, and there saw two cases of plants which had just arrived from Mexico. Among the contents were the stumps of a strange looking Euphorbia which, after a few months growth, showed some very brilliant crimson bracts. As soon as I was located I made a small investment in the plant, grew the bracts to the enormous size of from eighteen to twenty-two inches. I sent in 1830 or 31 some plants to my valued friend, the late Mr. McNab. At a breakfast party in Glasgow the amiable lady of the late Sir William Hooker gently chided me for imposing my Johnathanisms upon them so soon, by describing a plant having a crown of terminal leaves as twenty inches in diameter, of

brilliant crimson. The tens of thousands sold in Covent Garden and this country every winter confirm all that I have represented.

"I now call your attention to the double poinsettia, for, from the dried specimen before me, I can give it no other name. It is a towering bunch of crescent formed bracts, at least eighteen inches high and as much in diameter. Such crowns upon well grown plants will surpass everything now known for table ornament, conservatory decoration, or the manipulations of the boquetist. On a recent tour through the grounds of Mr. Isaac Buchanan, the millionaire florist of New York, he drew me towards two plants of familiar outline, but on inspection I discovered a plant entirely new to me. 'Is this the double poinsettia?' I asked. 'It is, and I paid one thousand dollars in cash for it,' was the reply. The saddle-like foliage has a more graceful outline than the present poinsettia, the nerves of deeper purple, the petiole has two erect stipules of about a quarter of an inch high, surmounted by two glands. I have no doubt, in the hands of a botanical professor, it will be made a new species and electrify the floral world."

In Spain the poinsettia is called the *Flor Pascua*, Easter flower, probably so named because it blooms at Easter time. The Mexicans call it *Noche Buena*, Christmas Eve flower, because it blooms on Christmas Eve.

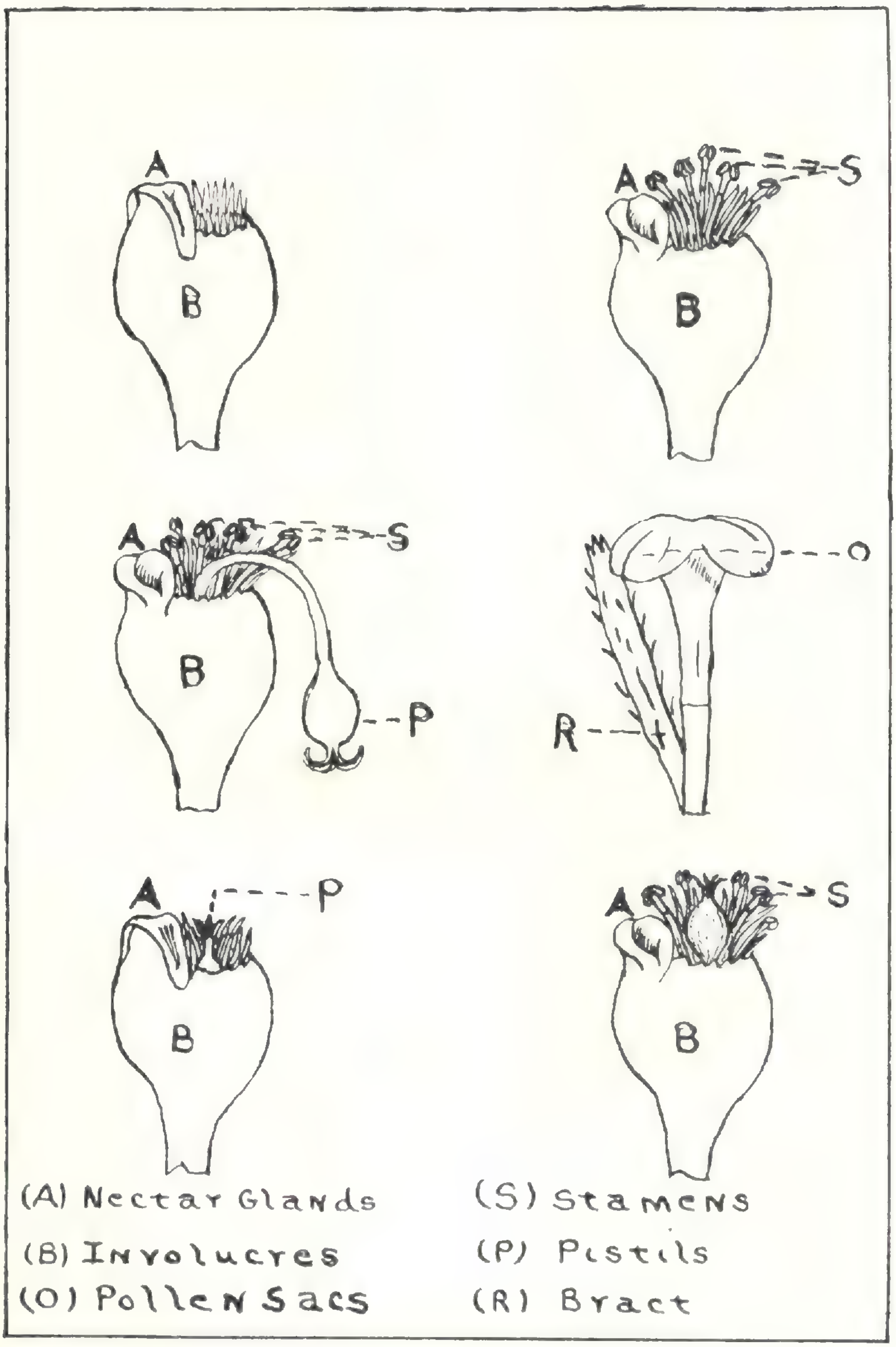
Poinsettias in the greenhouse seldom grow to a height greater that five or six feet, with stems seldom over a half inch in diameter. In Costa Rica and certain other tropical countries they make such sturdy plants that they are used for hedges. The immense size to which they grow in their native habitat is interestingly related by Mr. James MacPherson in the "Gardener's Chronicle:"

"I have seen this gorgeous poinsettia growing in gardens at Malta, Alexandria, Madras, Bangalore, and at various elevations on the neighboring hills and I think a note of the circumstances under which it appeared to the greatest advantage may be of interest. At Malta, Alexandria, Madras, and Bangalore the specimens I observed were all more or less spindly and naked, but less so at Malta and Bangalore than

at the other places. * * * There is one large bush in particular in the garden of Judge Cockburn as big as the largest Aucuba I have ever seen, say fifteen feet through at the base, and nine feet high. These shrubs are never pruned and never bare of leaves, although they are partially so in the dry season, and as for the whorls of bracts, no mere pen and ink can describe them—individual leaflets some eight or ten inches long by four or five inches broad, a dozen or fourteen in a whorl * * *."

Mr. Andrew Meikle, at Read Hall in Whalling, Lancashire, states, in the "Gardener's Chronicle," 1872, that a poinsettia known to be thirty years old covers an area on a wall at Moreton Hall of over forty square yards.

The term flower is often incorrectly applied to attractively colored parts of a plant. In the poinsettia the brilliant red bracts are not true flowers but are modified leaves forming a whorl or crown around the inconspicuous flowers at the top of the plant. The male and female flowers are borne in small green cups which form a rather dense cluster at the end of the stem, the female flower being borne in the center of each cup, surrounded by numerous male flowers. The male flowers near the center of the cluster mature before the female, which are aborted and do not appear outside the cup. At the outer edge of the cluster the female flowers precede the male, which mature later. The female flowers before pollination are erect, extending above the male, but after pollination they are curved over the side of the green cups. Diagrams of flowers and flower parts, showing different stages of development, are shown in the accompanying figures (pl. 37). The female flowers do not seem to be very receptive to pollination either by pollen from parent plants or from closely related species. This may be accounted for by the fact that in its native tropical region high temperatures prevail, which may be necessary to stimulate growth within the pollen grain; or it may be that the sunlight in the tropics is more continuous than in this climate, and when pollination occurs the sudden change in intensity of sunlight may fatally arrest germination within the pollen grain. Certain flowers in tropical countries



DIAGRAMS OF POINSETTIA FLOWERS AND FLOWER PARTS SHOWING DIFFERENT STAGES OF DEVELOPMENT.

are often pollinated by unrelated species of plants and thus act as an agent in the process of fertilization.

Hybridization of pink, white, and red varieties of poinsettias was undertaken at the Garden in November, 1923, by Mr. H. E. White, a student in the School for Gardening. This experiment was carried on under controlled conditions. Self-pollination was prevented by removing all the male flowers from plants that were to serve as female parents in a cross. The plants were kept free from ants, which are attracted by the nectar secreted by the glands on the flower cups and which are sometimes instrumental in pollination. The following crosses were made, each pollination being repeated at regular intervals for a definite length of time. In each case the female parent is written first:

Red x Red	Pink x Pink
Pink x Pink	White x White
Red x Pink	White x Red
Pink x White	White x Pink

Self-pollinations of the different varieties were made at the same time, and other plants, unpollinated, were used as checks. Even with constant attention in the application of pollen to the female flowers at various stages of maturity, the plants so treated showed a decided reluctance toward setting seeds. It was not until December 23 that any increase in size of ovaries on the pollinated plants could be observed. On January 7, four seed pods bearing three seeds each had formed from the following crosses:

Red x Red	Pink x Red
Red x Pink	Pink x White

Four months was required for the seeds to mature and about two weeks for germination after planting. The seedlings were very vigorous and by December, 1924, were as large as plants from cuttings made that spring. At a height of about four feet they produced whorls of bracts measuring from eight to ten inches in diameter. Plants resulting from the crosses showed bracts colored as follows:

Red x Red—Red	Pink x Red—Red
Red x Pink—Pink	Pink x White—Pink

Structurally there was no noticeable variation from the parent except for slightly added vigor. The self-pollinated plants did not set seeds, and it has been observed that among the great number of plants grown every year for display the same is true. There would therefore seem to be a high degree of self-sterility in the poinsettia. No reference has been made by collectors as to the method of seed production by plants in tropical countries.

When one considers that the plant can be just as quickly grown from seed as from cuttings, propagation of the poinsettia by seed for commercial purposes is a point not to be disregarded. Saving in bench space necessary to bring old plants into growth for cuttings, and also in the time spent in making preparations is a matter worthy of consideration. At present there seems to be no feasible means of growing plants successfully in large quantities from seed. It might, however, be possible by hybridization to develop a plant that would be self-fertile. *Euphorbia heterophylla*, our native poinsettia, is very self fertile, and by crossing this variety with *Euphorbia pulcherrima* a variety might be obtained that would readily produce seeds.

NOTES

Mr. G. H. Pring, Horticulturist to the Garden, gave an illustrated talk before the Men's Club of the Clifton Heights Presbyterian Church, November 3, on "The Royal Botanic Gardens, Kew, London, England."

Mr. Pring has given his lecture, "Collecting Orchids in South America," before the following audiences recently: Iowa State College, Ames, Iowa, November 5; the Kirkwood Garden Club, Kirkwood, Mo., November 13.

Mr. Pring spoke before the Florists' Club, November 16, on the "Iowa State Flower Show."

Recent visitors to the Garden include the Hon. Sam C. Baker, Governor of Missouri, his wife and daughter, November 12; Dr. Vladimir Ulehla, Director of the Institute

of Plant Physiology, Masaryk University, Brno, Czecho-Slovakia, November 18; and Mr. E. J. Palmer of the Arnold Arboretum of Harvard University, November 19.

Students entering upon work in the graduate laboratory for the academic year are as follows:

Rufus J. Lackland Fellows.—Clarence E. Kobuski, B. S., Cornell University, M. S., Washington University, reappointed second year; David Carleton Neal, B. S., Mississippi A. & M. College, M. S., Washington University, who held a Lackland fellowship in 1916-17 and now holds the position of professor of plant pathology and pathologist to the Mississippi State Plant Board and Agricultural Experiment Station, Mississippi A. & M. College, Agricultural College, Miss., has been reappointed to a Lackland fellowship and also holds a special fellowship from the American Fertilizer Association; Emery R. Ranker, B. S. and M. S., Utah Agricultural College, assistant, department of horticulture, Utah Agricultural College, reappointed second year; Fanny Fern Smith, A. B. and M. S., Washington University, reappointed third year.

Teaching Fellows.—Esther L. Larsen, A. B., University of Montana; J. Paul Reeves, A. B., State Teachers College, Peru, Nebraska.

Research Assistant.—Ella Pumphrey (Mrs. Harry M.) Miller, A. B. and M. S., Ohio Wesleyan College, graduate assistant, University of Illinois, teaching fellow, Washington University.

Instructors in the Henry Shaw School of Botany of Washington University.—Everett Fogg Davis, B. S., Rutgers University, teaching fellow, University of California, reappointed second year; Dorothy M. (Mrs. Edgar) Anderson, A. B. and M. A., Wellesley College, formerly teaching fellow, Washington University, appointed assistant in botany.

Mr. Teikichi Fukushi, who received his degrees at the Imperial University of Hokkaido, now professor of botany at the Agricultural College, Tottori, Japan, is on leave of absence from his college, and is registered for graduate work.

STATISTICAL INFORMATION FOR OCTOBER, 1925

GARDEN ATTENDANCE:

Total number of visitors	15,715

PLANT ACCESSIONS:

Total number of plants received as gifts	94
Total number of seed packets received as gifts	1

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	13
Total number of books and pamphlets donated	99

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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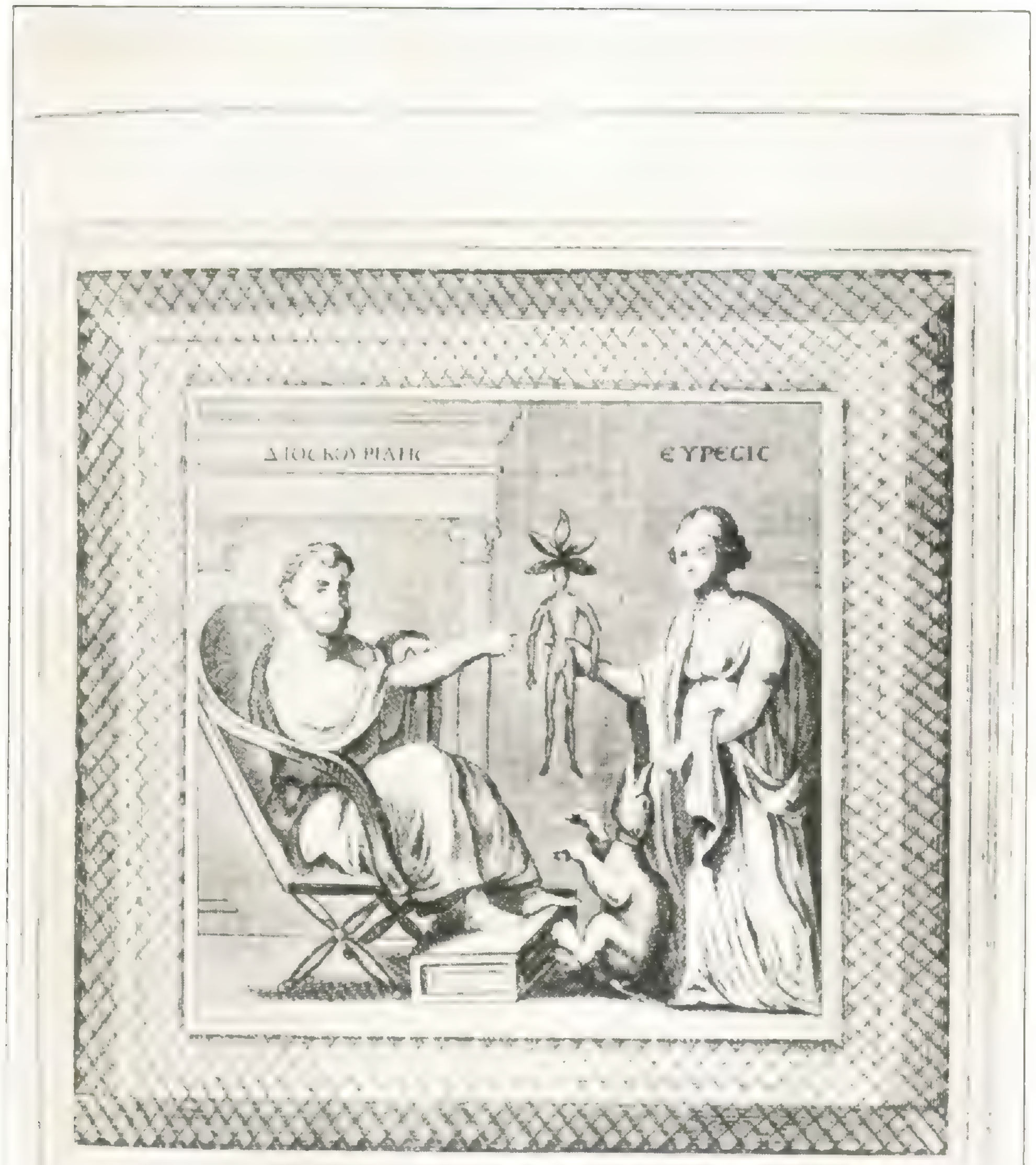

Discovery of Medicinal Plants by Dioscorides

Missouri Botanical Garden Bulletin

Vol. XIII DECEMBER, 1925 No. 10

THE QUEST OF THE MANDRAKE

Among the plants rich in folklore the mandrake stands preeminent. This plant, of which *Atropa mandragora* is the Linnæan designation, is a member of the family of Solanaceæ, which includes many powerful poisons and narcotics. Its distribution range extends from southern Asia on the east, to southern England, on the west, while it occurs most frequently along the north coast of the Mediterranean and particularly in Palestine. The following description of the plant is contained in Collcott's "Scriptural Herbal" (London, 1842): "The root is spindle-shaped and in colour not unlike a parsnip; when old it becomes forked, and it runs underground to the depth of four feet or more. Immediately above the root is a tuft of leaves like an open lettuce, and from the centre of the tuft springs the flower. The flower of this country [England] is white, while that of Palestine and the East is purple. In England the fruit is green and no bigger than a nutmeg. In Palestine it is as big as a small apple and of a beautiful ruddy colour and a sweet smell."

We first hear of the mandrake in Palestine, 1753, B. C., where Reuben finds a fruit, called dudai, in the field and brings it to his mother Leah. This fruit, which the Septuaguint translates as "mandrake apples", Rachael buys from her sister Leah with a promise that she will cause Jacob to caress her. Rachael bought the mandrake as a love-amulet, and shortly afterwards a son is born to her (Genesis, XXX, 14-23). This incident in the Pentateuch is probably the earliest mention of the mandrake in literature. It

is here also that we may look for the source of the subsequent attribution to the mandrake of powers of love and fertility.

Contrary to some opinions, the spread of the mandrake legends does not appear to have been eastward at first, for the next well-authenticated mention of it is in the "Historia Plantarum" of Theophrastus, about 310 B. C. The ball has now been rolling for a long time since the days of Jacob, and the legend has become much more complicated. Theophrastus writes: "It is said that one should draw three circles around a Mandrake with a sword, and cut it with one's face towards the west; and at the cutting of the second piece, one should dance around the plant and say as many things as possible about the mysteries of love." Dioscorides, writing about 75 A. D., repeats Theophrastus, and adds the information that the mandrakes are classified into white and black, and also male and female plants. This has led Rendell Harris, in 1916, to form some interesting theories on the probability that the mandrake is a personification of Aphrodite in Greece, for there are traces of a black Aphrodite in Thessaly and in Cyprus, and also in Corinth. In Cyprus, moreover, there was a bearded Aphrodite, strange as it may seem to those of us who have always thought of her as a standard of feminine charms, and certainly not as a bisexual monster. Furthermore, to show her connection with the drug, Farnell (Cults, II, 657) tells us that "at Oropus she shared an altar with Athena the healer, and the daughters of Asklepios." As a matter of fact, after having reviewed the evidence, we are able, as Harris writes, "to behold Aphrodite emerging from the soil much clearer than the Greeks saw her rising out of the sea." And since we have traced the mandrake from Palestine, we see that she is "an immigrant in the Greek Pantheon, an alien, however desirable, and however much at home."

We find evidences of the relationship in statues and coins. We have a terra-cotta figure of Aphrodite from Corinth, of which both hands are held against the breast, with a dove in the right hand and an apple in the left. Then there is the silver denarius of Sabina, the wife of Hadrian, show-

ILLUSTRATION OF THE MANDRAKE FROM "MISCELLANEA CURIOSA" OF THE "ACADEMIA NATURAE CURIOSORUM."

ing a representation of Venus extending the apple in the left hand. The printed words "Veneri Genetrici" are significant. Aphrodite's apple cannot be Apollo's apple. One is the oracular apple; the other, the love apple.

The mandrake symbolism leads us to understand the strange results of Atalanta's race. The apples were not of mere karat gold, but of the gold of the love apple, for they were gathered in Aphrodite's own garden. Ovid says plainly enough that Atalanta was in love with Hippomenes.

If we think that the Greek developments of the legend are fanciful, let us turn to the East, where we now have evidence of the mandrake. From Baaras, in Syria, Flavius Joseph (37-93 A. D.) writes in his "De Bello Judaico" of the plant which possesses the color of fire, and which towards evening sends forth a ray of light like lightning. It may not be touched until after it has had certain concoctions poured upon it, after which the ground should be loosened and a dog tied to the root. Then the dog is left, and in its struggles to escape, the plant is torn from the ground, killing the dog by its frightful screams. In return for its capture, however, the plant will help diseases, frighten away demons, and act as a love potion; for after the dog has died, the plant is not only harmless but highly beneficial. This is surely the mandrake, called by the Syrians and Arabs "The Devil's Candle." Without further reference in detail, it may also be stated that in China and India, the chief authority for mandrake legends is Cou Mi (1230-1320 A. D.). A fragmentary translation of this noted author of the Song period is as follows: "Some thousand li towards the east of our country, the earth produces an excessively strange and poisonous thing, and seems to affect the appearance of a man's shape; in all, it has the general appearance of ginseng. It is called Ya-pu-lu." He repeats the Syrian method for taking the plant, and adds that the root was used as an anæsthetic in operations for many centuries. In India and the Indian Archipelago, the mandrake was confused with the Dhattura (*Datura ferox* L.) and its legends there have not been fully reported.

Returning with the spoils of the East, crusaders from west-

ern Europe very probably brought with them eastern superstitions and myths, the mandrake among others. It is there that we meet with the mandrake legend in its rounded form, including finally the story that it was not found growing save under the site of a gallows, nourished by the humours and juices of the suspended person, especially if he be innocent. We are reminded of the ungent with which Medea supplied Jason, made from the flower which had been fed by the ichor of the "dear martyred Prometheus". Moreover, the "sex" of the mandrake was determined by the sex of the hanged person.

In Germany, the mandrake, on account of its narcotic properties, soon became identified with the alrunen, or witches, and finally the two became completely merged, the mandrake taking the name of alraun, or alrune. There, Grimm tells us, a man bearing alraun was believed to be able to change to a child, and conversely from childhood to age at will. However, in this case, the mandrake had to be fed and dressed like a doll.

In France, the term mandragora evolved through mandegore to the vernacular form "main-de-gloire," an actual hand to be dug out of the ground. The old tradition is not much changed. Chéruel, in his "Dictionnaire Historique des Institutions Moeurs et Coûtumes de la France" relates that the main-de-gloire is believed by some ignorant peasants to be able to fend off poverty, providing that the owner clothes it in pretty drapes of silk or linen. Chéruel also quotes a remarkable story from St. Palaye. He fell into a conversation with a peasant who told him that the main-de-gloire will only grow at the base of oak trees bearing mistletoe, and that whoever finds it must give it nourishment in the same quantity daily, or he would die. But for recompense the main-de-gloire would give over night the double of whatever had been given it.

Later, in "Les Secrets du Petit Albert" (Lyon, 1718) we read the account of a peasant who had a root of human shape which he had received from a gypsy. He buried it in a grave at a lucky juncture of the Moon and Venus and sprinkled it with milk in which three field-mice had been

drowned. After that, the root became more human-like than before. Later, he placed it in an oven with vervain, and wrapped it afterward in a dead man's shroud, and as long as he kept it, "He never failed in luck at work or at games."

In England, the mandrake is mentioned in much of the best literature of Shakespeare (Romeo and Juliet, IV, 3, 47; Henry IV, II, 3, 2; Othello, III, 3, 330; Anth. and Cleo., I, 5), and a well-known verse of Ben Jonson is the incantation of the witch in the "Masque of Queens:"

> "I last night lay all alone
> On the ground to hear the Mandrake groan;
> And plucked him up though he grew full low;
> And as I had done, the cock did crow."

In the English herbals we find much traditional reference to the mandrake, although we are disappointed in continental herbalists, such as Matthiolus and Hieronymus, who give barely more than the medicinal use of the plant as a drug. In Gerarde's "Herbal" (1636) we read: "There hath been many ridiculus tales brought up of this plant, whether of old wives, or some runnagate surgeons, or physickmongers I know not, but sure some one or moe that sought to make themselves famous or skillful above all others were the first brochers of that errour I speake of. They adde further that it is never, or seldome to be found growing naturally, but under a gallowse, where the matter that hath fallen from the dead body hath given it the shape of a man, and the matter of a woman, the shape of a woman, with many other such doltish dreams. They fable further, and affirme, that he who would take a plant thereof must tie a dog thereunto to pull it up, which will give a great shreeke at the digging up; otherwise if a man should do it he should surely die. Besides many fables of loving matters, too full of scurrilitie to set forth in print, which I forbeare to speak of. All which dreames and old wives' tales you shall from henceforth cast out of your books and memory, knowing this, that they are all and everie part of them false and most untrue: for I myself and my servants also have digged up, planted, and replanted very many, and yet

never could either perceive shape of man or woman, but sometimes two, and ofttimes six or seven branches coming from the main great root, even as Nature listeth to bestow upon it, as to other plants.'' How many interesting bubbles the spirit of investigation has exploded!

Lord Bacon in his ''Natural History'' refers to the use to which mandrakes were applied in his time. ''Some plants there are, but rare, that have a mossie or downie root, and likewise that have a number of threads, like beards, as Mandrakes, whereof witches and impostours make an ugly image, giving it the form of a face at the top of the root, and leave those strings to make a beard down to the foot.''

Parkinson also calls attention to the ''Scurrilities of the *Mandrakes* and *Womandrakes*'' in his ''Theatrum Botanicum,'' illustrating the interesting etymological change from the classical ''mandragora'' to the English mandrake, meaning ''man-dragon'', analogous to the French ''main-de-gloire.'' Logic gave to the female mandragora the name ''womandrake'' or ''Woman-dragon.''

As a final development of the quest of the mandrake, we unexpectedly come not only to our own times, but almost to our own door. Frederick Starr (Am. Ant. & Or. Jour., XXIII, 267) writes these astonishing words: ''Here in Chicago is a man of great wealth and influence among Orthodox Jews; he mourns the fact that no child perpetuates his line; he has been interested in the return of the Jews to Palestine, and has given largely to the cause. The Jews of Palestine, knowing of his family sorrow and appreciative of sympathy, sent him a Mandrake with their best wishes.'' We find that at least the rudiments of mandrake legend are among us still.

WEEPING TREES

There are many trees that weep,—ashes, oaks, willows, alders, spruces, elms, laburnums, dogwoods, maples, hemlocks, hollies, hornbeams, cherries, birches, and beeches. Not that these trees actually drip salt tears on the passer-by; merely that their branches, and in extreme cases the main stem,

are more or less pendulous and hang down in what our forefathers considered a melancholy attitude. In old American graveyards there will commonly be found on tomb-stones of the early nineteenth century a crude representation of such a tree. This is the weeping willow, originally a native of China. In its wild state along the Yangtse River it varies considerably, and the more extreme forms have been selected for cultivation. It has since very early times been commonly planted in China and is a familiar object in Chinese paintings and porcelains. So symbolical of grief did it seem to our ancestors that it was transported to all parts of the world and planted (with its various hybrids) in their graveyards.

While a few other trees, as for instance our native silver maple, may have normally pendant branches, most of our weeping trees are not natural forms. Just as certain human abnormalities (dwarfs, hunchbacks, albinos, etc.) have appeared in every race and nation, so certain freak forms have been found among the seedlings of every common species of tree. There are dwarfs, yellow-leaved or "golden" varieties, purple-leaved, cut-leaved, and weeping varieties. Also we have the purple-leaved beeches, alders, maples, cherries, and apples, the cut or fern-leaved beeches, alders and ashes, and scores of other forms. Since trees can be propagated by cuttings or grafts it is a simple matter, once one of these freaks has appeared, to make cuttings from its twigs and produce any number of similar individuals. A generation ago these peculiar forms were very much admired and quite commonly planted, but fashions come and go in gardening, as in everything else, and weeping trees, like funeral rings, have apparently had their day. In the "Horticulturist," a magazine devoted to "rural art and rural taste," for the year 1867, is an elaborately illustrated article on "Drooping deciduous trees," which describes and figures practically all the forms then known which exhibited this habit. The following quotation contains some advice which might well be heeded at the present time:

"Within a few years the popular taste has been largely turned to the introduction of drooping trees as objects of

graceful beauty, harmonizing with the smoothness and verdure of a lawn, or the high keeping and neatness of a pleasure-garden. Indeed to such an extent has this taste prevailed, that the very object aimed at in their introduction has been often defeated by a too free use of them, as well as by their arrangement in masses, when their side branches—which are their peculiar beauty—are intermingled or hidden entirely, and their too heedless distribution on all sides.

"Drooping trees, like water fountains, are dangerous in the hands of those who attempt their use in the decoration of grounds without possessing a considerable knowledge and good taste in the composition of a landscape."

Not all of the weeping varieties exhibit the deformity to the same degree. The weeping beech (*Fagus sylvatica* var. *pendula*) is an example of one extreme. The trunk, though not erect, angles upward irregularly until the tree comes to have somewhat the outline of a cumulous cloud and may reach a height of over fifty feet. Probably the most interesting specimen in this country is growing in what is now Washington Place, Flushing, Long Island, on land formerly belonging to the Parson's nursery. The tree is now well over eighty years old, and its fantastically billowed branches enclose as much space as a small circus tent.

The weeping mulberry (*Morbus alba tartarica pendula*), on the other hand, is too weak to stand alone. It originated as a chance seedling in the John C. Teas Nursery, at Carthage, Missouri, about 1883. The original tree, if one may call it by that name, sprawled about over the surface of the ground, looking very much like a small-leaved pumpkin vine. The peculiar umbrella-shaped specimens common in Saint Louis dooryards are produced by grafting scions of this weeping form on to the limbs of a normal seedling. As in nearly all grafts the two parts retain their individuality although growing as one tree. The trunk, having already reached its height, merely enlarges in diameter from year to year. The new branches hang straight down unless supported, and may eventually reach the ground where they creep along in vine-like fashion. In most specimens, the

STANHOPEA BUCEPHALUS.

STANHOPEA WARDII

difference between the stock and scion is so great that the line where the two tissues meet is easily discernible. When the head of such a mulberry has been cut off below this joint, old buds which have lain dormant in the stem come to life with the new rush of food and the owner is surprised to see his little mulberry umbrella shooting up into a real tree.

SOME RARE ORCHIDS RECENTLY IN BLOOM AT THE GARDEN

Stanhopea Bucephalus (*Wax Orchid*)—The species *S. Bucephalus* was obtained from the collection of Mr. C. W. Powell, of Panama, in 1924, and flowered for the first time in the Garden during July, producing six large perfect flowers upon a single spike. It first flowered under cultivation in the garden of the Horticultural Society of London in August, 1843. This species is often mistaken for a variety of *S. osculata*, but the short ovary of *S. Bucephalus* is a distinguishing feature.

The flowers are very fragrant, of a tawny orange color, marked with large crimson spots; sepals and petals reflexed, the former broad; lower part of the labellum curved, boat-shaped, bearing two curved horns, and a broad fleshy middle lobe; column green and white spotted with purple.

The genus Stanhopea, named in honor of Earl Stanhope, president of the Medico-Botanical Society of London, embraces upwards of fifty species native of tropical America. They are rarely seen outside of botanical collections, owing to the fact that the pendulous flowers remain open for only two or three days. In their native environment they are epiphytic upon the branches of trees, the pendant spikes of waxy flowers being produced from the base of the pseudobulbs. In cultivating, it is necessary to grow the plants in baskets to permit the spikes to pass through the base of the growing medium. Frequently the spike will force its way through the center of the basket. During the summer the plants grow and flower much better when placed outside in the shade of trees or under a lath house, instead of in the greenhouse.

Stanhopea Wardii.—This species, with its yellow flowers, is one of the showiest of the genus. It has been in the Garden collection since 1918, having been presented by Mr. C. B. Nicholson, of Clifton Heights, St. Louis County. The original plant has since been subdivided into half a dozen plants. Plate 41 shows an unusually fine flower spike bearing eight well-developed blooms which equals the maximum number found in the tropics. Its fragrance was so strong that it permeated the entire greenhouse. This species is a native of Guatemala.

The pseudobulbs are dark green, ovate, about two inches long, supporting a large ovate leathery dark green leaf. The flowers are pendulous, produced from the base of the leading parent bulb, of a golden yellow color spotted with crimson; lateral sepals round-oblong, concave, acute; petals narrow or lanceolate with undulated margins; lip or labellum has a large deep purple velvet spot at the base.

Maxillaria picta.—The earliest record of this interesting orchid is in 1832, when it was described in the "Botanical Magazine," plate 3154. It was received by Mrs. Arnold Harrison, of England, from her brother who discovered it in the Organ Mountains of Brazil. The Garden obtained a small specimen from the New York Botanical Garden in 1912. Since that time the plant has been divided into three good specimens which attests its adaptation to cultivation in this country. It is commonly called the "painted maxillaria" because of the peculiar purple markings of the flowers upon a deep orange base.

The pseudobulbs are ovate, dark green, clustered, obscurely furrowed about two inches in height and supporting two strap-shaped leaves about one foot long. The flowers are produced independently from the base of the developed pseudobulbs and are four to eight in number, depending upon the health of the plant. The petals are oblong-linear, acute, nearly equal; the sepals are larger and expanded, both sepals and petals being orange-yellow, intermittently spotted with purple within, externally almost white and bearing the same purple markings; the lip is oblong, creamy-white, sparsely spotted with purple, three-lobed, the disk possessing an

MAXILLARIA PICTA.

CAMARIDIUM AFFINE

oblong downy swelling; the lateral lobes are incurved, the terminal one somewhat recurved, cordate, acute. Both the column and anther-cap are black-purple in color.

Camaridium affine (*Schltr.*)—This interesting new species is from the collection of Mr. C. W. Powell, of Panama. It is a handsome botanical species flowering for the first time in this country during the first week in November, the blooms lasting only a few days. Its pure white waxy flowers should warrant its place as one of the best of the genus.

The plant has a compact habit of growth, despite the fact that the young shoots are formed upon ascending stems. However, the stems, with age, become pendant, for the purpose of attaching themselves to the growing base or the bark of trees, to form new plants. The young growth possesses five to ten leaves; the basal ones form bracts protecting the rhizomatous stems which die as the bulb develops. The mature pseudobulb possesses two terminal and two basal leaves which are persistent, the upper pair eight to ten inches long and half an inch wide, the basal pair five to six inches long and half an inch wide. The pseudobulbs are ovate, compressed, about two inches high and one inch wide. The flowers are two inches broad, white, waxy; the petals are ovate, strap-shaped, acute, with strap-shaped sepals; the labellum is suborbicular, trilobed. Under cultivation the plant is grown in a basket containing two-thirds peat and one-third sphagnum moss, at a temperature from 60° to 65° F.

Oncidium panamense (*Schltr.*)—This is a new species obtained from the collection of Mr. C. W. Powell, of Panama, in 1923 and flowered for the first time in this country during July. In habit it closely resembles the West Indian species, *O. altissimum,* because of the small flowers borne upon an attenuated spike. When not in bloom it may easily be mistaken for *Oncidium sphacelatum,* a species in garden collections in this country. The plant grows well under cultivation and undoubtedly is an easy bloomer.

The pseudobulbs are elongate-ovate, compressed, deeply furrowed, four to six inches long and two and one-half inches wide. The leaves are long-ensiform; the terminal pair two feet long and one inch wide, the basal pair which clasp the

base of the pseudobulb much shorter. The inflorescence consists of drooping racemes five to seven feet long, bearing short panicles six to eight inches long. The flowers are small, less than an inch across; sepals and petals are linear, margins undulated, yellow barred with reddish brown; labellum or lip fiddle-shaped, the basal lobe reniform, yellow, the narrow portion above faintly blotched with reddish brown.

NOTES

Dr. George T. Moore, Director of the Garden, spoke before the St. Louis Florists' Club, December 10, on "Relations between the Garden and the Florists."

Dr. Carl C. Epling, formerly Rufus J. Lackland Fellow at the Garden, now of the University of California, Southern Branch, spent a part of December in the Garden Herbarium and Library.

Mr. G. H. Pring, Horticulturist to the Garden, gave the lecture "Collecting Orchids in South America" before the Traffic Club, in the Chamber of Commerce Building, November 16; and before the Parent-Teachers' Association of the Clinton School, December 3.

Recent visitors to the Garden include Mr. Francis S. Robinson, of the firm of Pearse-Robinson, Landscape Architects, Des Moines, Iowa; Dr. D. T. MacDougal, Director of Botanical Research, Carnegie Institute of Washington; and Prof. Juan Balme, of the Mexican government commission.

The second number of Volume XII of the Annals of the Missouri Botanical Garden has recently been issued with the following contents: "Colloidal Sulphur as a Spray Material," by H. C. Young; "Pigment Studies with Special Reference to Carotinoids in Fruits," by Grace E. Howard.

ONCIDIUM PANAMENSE

STATISTICAL INFORMATION FOR NOVEMBER, 1925

GARDEN ATTENDANCE:

Total number of visitors..... 53,464

PLANT ACCESSIONS:

Total number of plants received as gifts..... 716
Total number of seed packets received as gifts..... 28

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 32
Total number of books and pamphlets donated..... 76

The Garden is open to the public every day in the year, except New Year's, Fourth of July, Labor Day, and Christmas—week days from 8:00 A. M. until one-half hour after sunset; Sundays from December to April, 1:00 P. M. until sunset, from April to December, 2:00 P. M. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Boulevard, on the Vandeventer Avenue car line. Transfer south from all intersecting lines.

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